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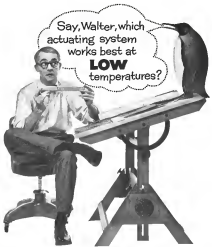
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Monel

Exhaust nozzles
Exhaust guide vanes
Hot gas turbine
Hot gas turbine

Stainless Alloys

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Exhaust nozzles
Exhaust guide vanes
Hot gas turbine
Hot gas turbine

Nickel

Exhaust nozzles
Exhaust guide vanes
Hot gas turbine
Hot gas turbine

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THE INTERNATIONAL NICKEL COMPANY INC.
87 Wall Street New York 6, N. Y.

Domestic

Chance Vought Aircraft reports its production line will be cut from the present 14,500 workers to 8,000 by early 1956 because of Navy's cancellation of a \$75 million contract for 96 A-1H's (Aviation Week Nov. 29 p. 16). The Duffin company says its jets will average approximately 500 mi. per hour in 1955.

F-99B engine program is being expanded at Boeing Airplane Co.'s Seattle Division, with new laboratories, test and research facilities added to support the USAF-sponsored guided missile project and more than 2,000 engineers working on piston aircraft development.

Small turbojet engines for drone and piston aircraft will be produced by Fairchild Engine & Airplane Corp.'s Engine Division, Farmingdale, N. Y., and General Electric Co.'s Gas Turbine Division, Lynn, Mass., under new competitive development contracts awarded by the Air Research and Development Command.

Boeing B-47 was in the air more than 47 hr and covered 21,000 mi. on a recent flight from the U. S. to England. When weather checked in at the Strabo jet's destination, it started back and forth to North Africa for several refueling stops waiting for the weather to clear. Total fuel consumption 75,000 gal.

DDC's simulator will be designed and built by Curtiss-Wright Corp. for the American World Airways. It is expected to be delivered in time to give PAA pilots "flight experience" before the airline gets its first new transport.

New aviation systems engineering laboratory will be set up by Radio Corporation of America in the Boston area, specializing in development of avionics for control systems. The lab is expected to employ 400 specialists and technicians by the end of 1955; will be headed by Dr. Robert C. Scammon, Jr., former director of Massachusetts Institute of Technology's Flight Control Laboratory.

Fairchild Engine & Airplane Corp. has acquired the military division of Keadell Controls Corp., Watkins, Mass., manufacturer of pneumatic valves and control devices. Operation of the business will be absorbed with Fairchild's Static Division. Ray Sherr, N. Y.



New Drop Tanks Double Copter's Range

A HO4S military fuel tank falls free of its hook-and-attachment under the tail of a Sikorski HO4S during tests of the modification, designed to increase the helicopter's endurance. The tank plus the HO4S's normal fuel capacity provide a total of 604 gal., slightly more than doubling the copter's usual load. Dropping the extra tankage evidently saves more space for cargo, the preliminary feature provides an additional safety margin. Both Air Force H-10B and Army H-10C are getting the new equipment. Tanks are made by Beech Aircraft Corp. and Fletcher Aviation Corp.

Improved Cessna 340 with new fuselage developed during the past year and a half is being marketed by the San Diego aircraft builder, will be delivered in 12 months after orders are placed.

New models become first operators of VOR equipment and eliminate the need for a separate airborne receiver has been developed and marketed by Civil Aeronautics Administration. The device is proposed for use with low-power enroute service in terminal area instrument approach aids at small airports.

Boil Aircraft Corp. has purchased Fly-Boat Research & Development Co. through an exchange of stock, plans to set its new headquarters, Calif., subsidiary to produce semi-rigid and rigid inflatable valves and sections.

Alfred W. Lawson, 55, aviation pioneer who won the first U. S. aerial contest in 1920 after he designed, built and flew a 24-passenger transport to prove the profitability of commercial aviation, died Nov. 29 at San Antonio.

Hugh M. Johnson, 55, former communications superintendent for the American World Airways' Latin American Division, died Dec. 5 of leukemia, Tex.

Financial

Berth Auerbach Corp., Wichita reports a net income of \$1,186,985 for the fiscal year ended Sept. 30 compared with a net loss of \$2,321,052 during the

previous 12-month period. Sales totaled \$3,815,415 during those 30 days. 457,793 including \$41,064,750 from a contract termination phase and subject to renegotiation. Earnings Sept. 30: \$80 million.

Boswell Aerospace reports its net income for 1954 is total approximately \$57 million. President Charles E. Boswell says this forecast is based on an estimated \$5.5 million for the first 11 months plus \$200,000 expected in December. Boswell also predicts Boswell will earn enough in 1955 to meet a 10-cent dividend, equal to the payment just declared.

International

"Things aren't" project at A. V. Roe Canada's Toronto plant has been abandoned by the Canadian government, but the company plans to continue its research on the aircraft—described as "a hot shaped very robust paper." Avionics spent so far by the government and Aero: \$4.5 million.

Supercub 7 turboprop has been type tested at 18,200 ft. thrust without restriction, robust or other boosting devices, reports builder: Aerovox. Supercub 7 is claimed to be the lightest yet constructed for any British type-tested engine.

Soviet Russia has sold its interest in East German's metal industry for an unspecified quantity of goods to be delivered by the People's government in future years, according to Pravda.

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Washington Roundup

Jet Tanker Review

Lockheed, Douglas, Convair and Boeing executives are watching closely the review being conducted by Defense Secretary Charles E. Wilson's office of the present USAF procurement award for the Boeing KC-119 interim jet tanker.

Wilson's decision on the interim tanker procurement will strongly influence USAF award on the ultimate tanker version, now subject of a hot design competition. USAF announcement of the KC-119 award was made while Wilson was out of town and opposed by Charles Anderson, Deputy Secretary of Defense.

Plant Cognizance Battle

Don't be surprised if the long-standing struggle between USAF and Navy for cognizance over the key Pratt & Whitney Aircraft engine plants flares again soon. Navy cognizance dates to World War II when main P&W engine developments were Navy-sponsored. Virtually all P&W development programs from the F37 on—and including the F37 turboprop, F37 turboprop and atomic engine—are now USAF financed.

Only remaining Navy-sponsored development program at P&W is the F37 turboprop project by diverting funds from the F37 turboprop project.

Wilson's New Problem

Defense Secretary Charles E. Wilson says he is better than expected at this time of the year. What he did not expect, he told New Orleans Chamber of Commerce last week, was "the problem of getting a little better acquainted with some new (economic) chairman of the Armed Services Committee and of the Appropriations Committee."

Wilson, who campaigned heavily for the GOP in the November congressional elections, said he is now approaching defense problems from the point of view that they are "above and beyond partisan politics." He said he now is more an American, both Republican and Democrat, basically are interested in security of the nation.

In spite of his problems with a new Congress, the Secretary has not lost his sense of humor. He and the governor of Louisiana offered to take him shooting with friends who have "wonderful land dogs."

Award Announcements Subside

Wave of Defense Department contract announcements put before the November elections did not appear to have let a moment for the Air Force. The Navy alone has followed up with regular award news. \$400,000 for about a month, the Army finally reported it expected to award \$85 million in procurement and production contracts during November. It did not list them or compare with awards but said the majority were for small orders.

USAF says it has no plans to state any more late in the year.

Last announcements were made on Oct. 30 (\$375 million) and Oct. 31 (\$3.2 billion). Air Force says these were made at that time only because a big list had accumulated and it will not make any more awards unless there are substantial awards to report.

Feeder Push

Look for a powerful thrust by local service interests at the next session of Congress to obtain through legislation and organizational pressure permanent Civil Aeronautics Board legislation and a secure Airline formula for competing subsidies.

After squabbling legislation in the Senate last session for permanent certification, the Administration has reduced its attitude to the extent of favoring permanent certification for some of the local. Strategy of the local service industry will be based on the security for attracting aviation, getting off subsidy payments soon.

Missile Pot Boiling

Washington observers are wondering when the USAF missile development pot will boil over. Defense interests of USAF and missile manufacturers on intercontinental ballistic missile developments are heavily assessed by a military security blanket, but odds are that they will erupt into public debate soon after Congress returns to Washington.

Shooting War

American air commanders on the fringes of the Iron Curtain are becoming increasingly restless by the growing number of incidents involving Russian fighters shooting down USAF and Navy aircraft.

Don't be surprised if there is more shooting back at the Russian airbases in the future, along the pattern of the Navy carrier-based aircraft that shot down two Red Chinese fighters during British transport plane operations in the South China Sea. Recent in which USAF and Navy aircraft were moving through the same airspace on all sides of the Iron Curtain is really underestimated by the public.

Where Was USAF Brass?

USAF brass was conspicuous by its absence at the launching of the Navy's first supercarrier, the USS Forrestal, Dec. 11 at Newport News, Va. Although many VIP military dignitaries made the short hop from Washington with Defense Department, Navy and Army brass, the only high ranking USAF official to show was Gen. Otto P. Weyland, Tactical Air Force Commander.

MATS Organization

Air Force continues to meet papers from Defense Department to organize the Military Air Transport Service as an integral part of the Air Force. The MATS agreement is that it would only increase paperwork involved in changing other elements of the Air Force for MATS service.

MATS was also the object of criticism from a House appropriations committee which complained over the assignment of such units as Air Rescue Service, Air Weather Service, Airways and Air Communications Service as a MATS responsibility.

Committee said that USAF directives had taken MATS beyond its original mission of providing air transport for the defense agencies. MATS officials will face the same changes from the new Congress.



THE PRESIDENT DROVE THE TRUCK

The phrase can come through long after the plane's closed, and all but the executive staff had gone home. That was over six hours ago. Now, it was midnight on a dark and lonely mountain road.

One more curve in the endless series of asphalt turns. Then the headlights picked up the small airplane—the crippled plane—the anxious looking man leaning in front of the lounge.

Airwork was delivering an oversized engine to a customer in trouble. The president drove the truck over 200 miles that night. Like every man in the company, he was taking his place in Airwork's tradition of Personal Service to the customer.

That tradition makes a business where the customer and his needs will always be important. You may never face an emergency as grave as that one. But the same intent and care will be ready to serve you, whether you need an engine, an engine accessory—or just an engine part.

Some of these days you will see a cream and blue business marked "Airwork Corporation". Talk to the man with it. Talk to someone grouping, ILS approaches.... do some hangar flying.

You'll see why so many pilots and plane owners—people like yourself—are switching their engine and accessory overhauls and exchanges to Airwork—the company of, by and for pilots.

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WHO'S WHERE

In the Front Office

John E. Johnson is president of the newly reorganized Argonne Corp., which will set up the Los Angeles firm for major engines within the aircraft industry.

Col. J. G. Vincent, co-designer of the first aircraft engine with such modified features production and the first diesel to power a plane, has retired as vice president-engineering of International Fuel Corp., Detroit (Aviation Week Oct. 25, p. 10).

Allen D. Mitchell has become vice president-manufacturing and assembly of General Dynamics Corp., New York.

Reginald C. Shindel has been appointed vice president in charge of the new Shipbuilding Division of Republic Steel, Chicago, C.I.M. New units include Robert J. Trevino.

Ray M. Wilson, co-leader of Frontier Airway, has sold his interests in the company and stepped as chief of operations.

Changes

Mr. Carl William S. Richardson (USAF, Ret.) has become manager of defense project coordination for Radio Corporation of America's Engineering Products Division, Camden, N. J.

John F. Tappert has moved up to general manager of Alcoa Manufacturing Co.'s Commercial Products Division, also will be general manager of the Company, Cold Spring.

Dr. Neil W. Lank has been appointed language planning administrator for Convair, will analyze the Sea Dragon company's development and production plans for the next 10 years.

Robert H. Isenhardt is now chief engineer of Boeing, replacing Col. A. William Arnold, Division at Seattle. Other changes: George Seader, chief project engineer, and W. H. Cook, chief of technical staff, selected as chief, Donald W. Poley, chief of preliminary design for the Seattle Division.

Dr. Peter J. Neugebauer, World War II plant manager of Germany's Air Research Institute and previous consulting engineer at Wright-Patterson AFB, has become a consulting engineer for the firm's Air Research Institute and Electric Co. engineering laboratory at Schenectady, N. Y.

Honors and Elections

Dr. M. H. Moore, president of United Aircraft Corp., has been elected chairman of the board of governors of Aircraft Industries Association for the first half of 1955. J. C. Gessert, president of Garrett Corp., is chairman for second half.

Robert E. Green, president of Lockheed Aircraft Corp., has won the Los Angeles Advertising Club's Monthly award for "most interesting program in aviation."

James L. Lohrke, managing director of Flight Safety Foundation, Inc., has been awarded the R. G. A. von Braun Award. He was named by the Royal Netherlands Aero-Club for "the most valuable contribution to flight safety."

INDUSTRY OBSERVER

The American World Airways is expected to sign the first contract soon for Boeing's commercial jet transport based on the 294,000-lb. gross KC-135 military tanker. PAA would use the Boeing jet transport for transatlantic service. Prospect of competition with British Overseas Airways Corp. also has spurred Pan American interest in the Douglas DC-7D powered by Pratt & Whitney R.B. 169 turboprops.

Pratt & Whitney Aircraft's Atlantic Engine Research Laboratory will be built on a 1,100-acre tract near Middleboro, Conn., about 30 mi. south of the main P&W plant at East Hartford. Construction on the 516,000-sq-ft facility is expected to begin late in 1955 with design of the laboratory scheduled for completion by next July. Design is being done by the New England division of the Army Corps of Engineers, Boston, Mass. USAF is financing the laboratory.

First of major engine fighters, a Lockheed F-90C whose structure was designed and built at the light-weight steel by East Coast Accessories, Pelham, N. Y., a subsidiary of Buena Vista, is at Matfield AFB for pre-flight inspection. The plane will make its first flight only in January.

Lockheed expects that its L-1449 turboprop-powered Super Constellation will be able to beat the shock speed of the de Havilland Comet 3 between New York and Paris. The T34-powered Comet will be able to make the flight in 10 hours, while the Comet 3 will require at least one refueling stop.

General Electric expects to flight test the first transport version of its SIF two-engine turbofan engine next year. The transport version will be equally convertible to carry either eight passengers or more than 1,200 lb. of cargo and will replace the T37 converted turboprop engines now used on the "Cockshill" design that maintains communications between aircraft carriers at sea and land bases.

Tumble which led to possibility of North American Aviation's F-100 has been attributed to a high-speed yaw encountered at speeds over Mach 1 which subjects the aircraft to side forces well beyond its design limit. The Super Sabre, in which NAA test pilot George Welch was killed, was heavily instrumented and more than half of these instruments were recovered after George and Art Brown investigated into the series of crashes in continuing, while the F-100 remains grounded.

De Havilland Cirrus, supersonic turboprop, will make its first flight in a modified Bell SA-4 Sparrow. Modification of airplane currently is being made at Wright plant.

Corbin-Wright Corp. has developed an airflow modulator to prevent excessive turboprop blade vibration at low rpm, a putting the new device on J65 engines now coming off the line. The unit costs is at \$3,000 per, guides the air into the roots of the compressor stages and turns it out out at 4,500 rpm.

Pasado Helicopter Corp.'s first YH-16, two engine, 40-passenger helicopter powered by P&W R2180s, has completed its structural flight testing program with less than 15 hr. on the aircraft over the first flight more than a year ago. The YH-16A, powered by two Allison T35 turboprop engines, is in ground testing stand with more than 20,000 lb. of ballast in cabin, ready for first power tests.

Douglas Aircraft has a new Navy contract for an aircraft designed by its El Segundo Division's chief engineer Ed Heinemann that will surpass both the F-40 and A-10 in performance.

ELF A. Pasado developed helicopter powered by a Wright R1300 engine replacing Continental B775, will make its first flight before Jan. 1. First aircraft will use only 400 of 400 hp, available. Second HUP-6, which will be ready only next year, will utilize full 300 hp.

Defense Directive Muddles Buying Picture

- Wilson's order for 'sound mobilization base' in armed forces procurement touches off confusion, criticism.
- Top officials ordered not to interpret document, are given 30 days to revise buying procedures.

By Claude Wiese

A major muddle appeared last week in Defense Department procurement circles because of a new directive issued by Defense Secretary Charles E. Wilson, ordering that every effort be made in buying to maintain a "sound mobilization base."

For more than a week after the directive was issued, strict censorship was maintained and many Pentagon officials at high levels were forbidden to discuss the directive publicly or attempt to explain it.

Flood of inquiries.—In addition, there was a possibility the directive violated the Small Business Administration Act of 1953, under which a federal agency may be required to "consult and cooperate" with SBA on procurement policies.

When the Wilson document was made suddenly after close of the annual business day, one newspaper quoted only the last of the directive and the new day received 400 inquiries from outside seeking press information. Major questions:

- Is the directive an actual change of military buying policies or a restatement of existing policy designed to help bring an armistice?
- Is planning procurement, the directive says, attention must be paid to "national mobilization supplies." How does a supplier get in this category?

Procurement officials in the Pentagon, involved not in strange interpretation of the directive, fell back of two parallel replies:

- The purpose of the directive, it stated in the text, is "to integrate" policy with mobilization plans. Those who say it has altered the procurement policy that they will be any change in procurement policy.
- They have 30 days to revise regulations, procedures and instructions to carry out the new directive. It is too early to discuss details.
- **False, Chicago.**—Response to the new directive from members of Con-

gress was equally diverse. Sen. Henry M. Jackson (D., Wash.), who had criticized Secretary Wilson for leaving large companies, particularly General Motors Corp., pointed the new order, calling it a "significant contribution to U.S. industry."

Sen. Edward J. Thye (R., Maine) expressed serious concern about the directive. He interpreted it as an order to act up a lot of preferred firms to receive "the bulk of defense contracts with no competition allowed from firms not on the select list."

One spokesman on Capitol Hill said he thought Jackson had made his statement before it was made clear exactly what the Wilson order meant.

Reporters who spent a week trying to penetrate the Pentagon fence uncovered a long list of possible interpretations, but an definite information.

• **Refuted Later.**—The Wilson directive, dated Dec. 7, repeated the Army,

Navy and Air Force to review proposed procurement of items on the Defense Department's preferred planning list, with consideration to:

- Maintaining multiple sources of supply.
- Geographic dispersal.
- Avoiding undue concentration of contracts in a few leading suppliers.
- Multiple awards.
- Preserving essential skilled labor forces.
- Utilizing existing open industrial capacity.
- Preserving essential employment opportunities and "backlog."
- Maximum subcontracting.
- Any other factors relevant to maintaining a sound mobilization base.

• **Financial Focus.**—The directive is aimed at Office of Defense Mobilization Order DMOG VII-7, it was noted. Most recent amendment of this order was dated Nov. 24 and consisted of deletion of one sentence from the original. The sentence:

"The general policy is that where supplies are not available to complete contractors on a bid basis shall be to evaluate the mobilization base to determine if the capacity can be sustained without addition of high cost producers."

Partial effect of the directive would be to permit the award factor to pay preference points for items if this preference is given a contractor's supplier to suppliers for use of the material listed in the Wilson directive of Dec. 7.

The Senate Small Business Committee had understood that Wilson forwarded some wording of contracts to other than low bidders. In view of the prohibition of the DDM and Wilson order, a spokesman said last week: "We now believe what is in the directive, and what is the egg."

• **Small Firm Threat.**—Both industry and Pentagon sources indicated that military buyers have been making a practice of giving a price differential to firms in question about the mobilization base would be threatened by giving an award to the low bidder. This is the school of thought that views Wilson's policy directive as a permanent document where people are to use the policies in their cases.

Viewpoint of the Senate Small Business Committee, as expressed by Sen. Thye in a telegram to Wilson, was

that the new order was a threat to small firms who are a "mobile and potent productive force in times of emergency."

- **Question put to Wilson by Thye.**
- **Was the Small Business Administration consulted in the preparation of this order?**
- **How will the directive affect the Joint Defense-Mobilization Program of the Defense Department and SBA?**
- **How will it affect the small business program of the military departments?**
- **To what procedure of delinquent contracts, by analysis and by dollar value, will the new policy apply?**

Thye said he was disturbed by a clause in the directive that calls for an increase use of negotiated contracts on the terms of the Annual Federal Procurement Act. He said this implied an end to price competition.

The Wilson directive started the Small Business Administration and the Senate committee as much as anyone else. It was then said, totally unexpected and effects to get further information were as futile for the committee as they were for the press.

CAB Blames Tower In Convair-SNB Crash

Collision of an American Airlines Convair and a Navy SNB Jan. 27 at Columbus, Ohio, was due to the failure of the Port Columbus Airport tower to control properly the traffic situation, Civil Aeronautics Board investigators said.

The Navy aircraft crashed at the airport, killing both occupants of the airplane.

The Board found that the probable cause of the collision was "a traffic control situation created by the tower local controller which he allowed to continue without taking the necessary corrective action." Failure of both crews to detect the situation through visual vigilance is listed as a contributing factor.

The accident occurred just after an air show when both aircraft were instructed to land on the same runway, and the tower allowed the two aircraft to approach almost simultaneously. After observing the patterns of the approaching aircraft, the tower advised the Navy plane either to turn a 360-deg. turn or to clear the field. When the Navy plane up and began its turn, it collided with the Convair. The Navy aircraft caught fire on impact, crashed and burned. The Convair landed safely, but the nose wheel collapsed during landing roll, causing extensive damage. None of the Convair passengers or crew was injured seriously.



WORLD'S LARGEST AIRCRAFT CARRIER, U.S.S. Forrestal, is tugged to dock for fitting

Forrestal Opens New Carrier Era

A new era in naval aviation was launched and an old regime ended very vividly at the 35,000-ton U.S.S. Forrestal did out of the growing dock at Newport News, Va., to become the first of the Navy's supercarriers to fast.

The giant Forrestal, twice the size of the largest World War II aircraft carrier, is the first of a series of 10 supercarriers planned by the Navy as its new "ships of the line" for atomic warfare at sea.

The Forrestal (CVA-99) will be followed by the Saratoga (CVA-60) being

built at the Brooklyn Navy Yard and the Hancock (CVA-61), also under construction at Newport News. The fourth supercarrier (CVA-62) will be built at Brooklyn and plans for a fifth will be continued in the fiscal 1955 defense budget.

• **Efficient Target.**—Navy hopes its role for the supercarrier in the operational requirements of modern warfare, it powered aircraft that demand a new type of operating area at sea, just as they require new types of aircraft on land. As the first of the super-carriers, the Forrestal is destined to bear the brunt of criticism aimed at naval aviation roles in atomic warfare.

Appearance of the Forrestal on the water of Hampton Roads seems sure to stimulate local debate in the area service controversy between USAF and Navy over the relative merits of long-range, land-based bombers and carrier-based fighters when the fiscal 1955 defense budget appears on Capitol Hill early next week.

• **Forrestal Features.**—Although some of the 27,000-ton Essex class carriers have been converted to steam catapults and control decks required for operating modern, high-speed jet aircraft at sea, the Forrestal is the first carrier designed from the start to meet the operational

Forrestal Specs

- Length: 1,005 ft. (equal to six city blocks)
- Height: 100 ft. to mast-top equal to 25 story skyscraper
- Displacement: 35,000 tons
- Speed: 30 knots
- Flight deck area: 4 acres
- Crew: 3,500 (including air group)
- Aircraft: 115 jet fighters and attack bombers
- Complement: 4,000-5,000
- Broken: 4, 400-edge type



AIROPLANE TURBINE FACILITIES will be consolidated under new plan at this government-owned Westinghouse plant at Kansas City.

Westinghouse Puts Millions in Jet Program

By Hubert Hertz

Kansas City-Westinghouse Electric Corp. has received a top-level management decision to expand and support its Aircraft Gas Turbine Division. It will spend \$39.5 million in corporate funds to begin the new program.

The new Westinghouse jet program involves:

- Construction of a \$12.5 million research and development laboratory adjacent to the government-owned plant now occupied by the division south of Kansas City. This laboratory will be designed by Westinghouse, Rudolph and Porter of New York has been awarded the architectural and engineering contract for the facility.
- Investment of \$7 million in Westinghouse's new jet engine development program aimed at producing new designs for military and civil markets.
- Establishment of a jet engine flight test center at the Olathe, Kan., Naval Air Station.
- Agreements of management, engineering and production staffs. The new management team is headed by W. Walter Smith, general manager, who joined Westinghouse from Spalding Corp. 11 months ago.

- Construction of six technical interchange and sales agreement with Rolls-Royce, Ltd. of England.
- Consolidation of the design of all the division's facilities at the Kansas City plant. Development facilities now occupied by the division at South Philadelphia will be absorbed by expansion of the Westinghouse Steam Turbine Division there.

Charles Price, Westinghouse president, expresses that the corporation is in the aircraft propulsion bus-

ness to stay and now is looking that determination with its own assets.

"Westinghouse has every advantage of staying in the jet engine business," Price says. "As a matter of fact, with the consolidation of our activities at Kansas City plus the addition of new, adequate laboratory facilities now under way, Westinghouse will be in a far better position to do the development and production work necessary to remain competitive in a major participant in the jet engine business."

• **Lack of Facilities**—Westinghouse is taking its headquarters in the jet engine business from a relatively low bid after initial success in producing the multi-flow design in the country with the 1,800-hp-thrust 1958 General World War II and the 3,600-hp-thrust 14 that performed well in Korea combat in McDonnell Aircraft Corp.'s carrier-based fighter fighters.

In holding an expanded jet engine development program on the 1,800-hp-thrust 14 and the 3,600-hp-thrust 14, Westinghouse was contacted by lack of modern development facilities and the engineering staff for test replication of the gas turbine component that its development facilities, expanded little since World War II, were in South Philadelphia. Its flight test facilities were split between Newark, N.J., and Dallas, and its production plant was in Kansas City.

In addition, Westinghouse aircraft turbine development was dependent on the National Advisory Committee for Aeronautics' wind-tunnel at Cleveland for certification and ultimate tests of its engines.

• **Consolidated Effort**—These factors did not combine to produce a swift development pace. As a result, the Navy replaced the 14 in a number of air-

craft production programs with engines that developed later. Recent Navy cancellations of Chance-Vought and McDonnell fighters powered by the 14 and 14B (November 1958 Nov. 20, p. 10) indicate the production run for these engines will end during 1955.

Recognizing these problems, Westinghouse management decided not to withdraw from the aircraft propulsion field but to consolidate, expand and improve its effort in an attempt to regain its earlier position as a leader in the business. The center gas turbine effort now will be concentrated in the Kansas City area with research, development, engineering and production of all under one roof and flight test facilities only 28 mi away.

The Aircraft Gas Turbine Division now occupies slightly more than 2 million sq ft of the 3-million-sq-ft government-owned plant at Kansas City, built by Pratt & Whitney Aircraft during World War II, and most development facilities in South Philadelphia. Employment at Kansas City now is 5,000 people working in two shifts, with 1,000 employed in South Philadelphia.

• **Modernization Base**—The Kansas City plant has all facilities required for aircraft engine production under one roof, including one of the largest investment casting facilities in the country. All the Kansas City machine tools are government-owned.

Although the Kansas City plant now is equipped for every type of manufacturing operation required in jet engine production, Westinghouse has expanded a subcontracting and supply network that provides a second source for all of its engine parts and will be retained as a mobilization base for emergency expansion.

The corporation also has begun to lay a solid research and development foundation on which to build its future sites and production plants. It is pursuing cooperation funds only which has been awarded a Navy-financed program to speed both the process of adopting development facilities and to finance privately development of new engines.

• **High-Power Turbines**—The new \$12.5-million laboratory will occupy about 230,000 sq ft and be equipped to do high-power testing, an expansion, turbines, afterburners and fuel systems. Construction will begin early in 1955. Westinghouse will build low-power component test facilities and is planning an aerodynamic laboratory.

Facilities for complete engine testing at an level conditions already are available in the plant's test cell area. Westinghouse does not plan any aircraft test chambers in the new development facilities at this time, although they may be added later.

• **Rolls-Royce Facilities**—Flight test facilities to be established shortly at Olathe will support a North American B-45 multi-engine bomber engine to meet the engine as a military pilot, but Chance-Vought F7U Corsair and a Douglas F3D. A large new experimental test machine shop now being located at the Kansas City plant for development work.

In addition, Westinghouse can use the experimental machine shop, development laboratories and flight test facilities of Rolls-Royce in England to augment its own efforts. Westinghouse has established a small test device for engine working with Rolls and is setting engineering personnel on those to test engine tests, with an average of one at the Rolls plants at all times.

The British company is doing some general design, modification design and other experimental work on Westinghouse property. Rolls also is maintaining a flow of engineering personnel to the Westinghouse development facilities in South Philadelphia and Kansas City. The current Rolls-Westinghouse

agreement, signed in 1953, is for eight years with option for renewal.

• **Development Philosophy**—Westinghouse engine development philosophy is based on two major considerations:

- Future engines will be an optimum size aircraft engines rather than simply the highest power output. Westinghouse engineers are endeavoring to work in the 1,000-3,000 hp thrust range, aiming at optimum combination of weight, power output, low frontal area and fuel specific rather than shooting for the highest possible power output for its cost in weight, drag and fuel.
- Future engines will be as simple as the present trend toward increased complexity in aircraft engines and making them more simple to operate and maintain.

Westinghouse engineers believe the present complexity of jet engines and their controls make it extremely difficult and costly to produce large quantities fast enough to meet military combat requirements. They are driving a concept effort to simplify design to make progress easier to manufacture in quantity and to increase their operational reliability in the field.

• **Walter Smith**—General manager, Westinghouse Aircraft Division, says that the division plans to work in the entire spectrum of aircraft propellers and that its future development will not be restricted to gas turbine types.

The division does not now have any active project for developing aircraft nuclear propulsion, but Westinghouse has been a pioneer in developing nuclear power for ships and civil use. It is likely that the Aircraft Gas Turbine Division is not unaware of the nuclear possibilities for these propulsion.

• **Rolls Market**—While its own development program is hatching, Westinghouse has the U.S. also and manufacturing rights for all Rolls-Royce engines except those sold as part of British-manufactured airplanes. Thus if Rolls sells its B.B. 119 turbojets to Douglas Aircraft Co. for the DC-7D (November 20, p. 13) and its helicopter

program, Westinghouse will handle the project. But it will not have anything to do with Capital Aircraft's purchase of Rolls' first helicopter as part of the Vickers Viscount transport.

There is strong American interest in the Rolls technology for its commercial markets. Chance, Lockheed Aircraft Corp. and Fairchild Engine & Airplane Corp. are selected in the 1,000-hp. But for military engine turbojets.

Westinghouse also is interested in manufacturing the Diet for the American market if sufficient business can be secured from a large enough market. Westinghouse manufacture of the B.B. 119 for the Douglas subsonic is another possibility.

• **Rolls Sales**—The Aircraft Gas Turbine Division already has handled the sale of the Rolls 1,800-hp-thrust 14 to USAF for expensive turbojet engines and, if required, will handle modification of the engine to American standards at Kansas City. Since there is no U.S. engine in this thrust class, there may be a wide market for the 14 in this country.

Westinghouse is aided in its American sales effort in Rolls engines by the small, British-made engine built by Lord Bess, managing director of the British firm, and J. D. Perkins, manager of its Aero Engines Division.

There also is some American interest in the Rolls engine type for the land and military jet transport. Westinghouse is pursuing the bypass design in its own development program.

• **James Flannery**—Although handling Rolls jet engines under license for American use, says that Westinghouse through a stock placed in its production facilities, part of it will deliver for Pratt & Whitney Aircraft, Westinghouse machines that has demand is looking its terms in its own development program, and the new engine it produces.

There is no doubt that Westinghouse is determined to make the effort required to get back into the field of the jet engine business. But it is not at least five years before the success of the effort can be accurately judged.



HIGH-POWER aircraft engine test facility shown in sketch with...

LOW-POWER test facilities, also to be built at Kansas City.

Lufthansa Expects Fast Comeback

But some observers say West German airline cannot overcome 10-year advantage held by its competitors.

Frankfurt—Officials of West Germany's Lufthansa predict the airline will make a rapid comeback after it resumes service Apr. 5, despite doubts of some observers that the recovery program after a career can overcome the 10-year edge held by competitors.

Dr. Karl Wengert, chairman of the Lufthansa board—a post he held before World War II, says: "Because Germany lies in the center of Europe, she has experienced great difficulty in obtaining adequate freedom of the seas. But the air is free and, to activate Lufthansa's routes, it is necessary only to obtain recognized landing rights in the necessary main traffic and trade routes."

"This has not been difficult because the aid of many nations now are flying to Germany, and they must give us recognized rights."

■ **U.S.-British Fight**—Meanwhile, competition between British and U.S. plane builders to sell the airline more equipment has become fiercely competitive.

Lufthansa actually took delivery in its first German 74D (Aviation Week Nov. 29, p. 78) and has in addition three of the San Diego-built transports on order. The order she has ordered four larger Constellation from Lockheed Aircraft Corp.

The British are trying to convince the Germans that the American aircraft are obsolete. ■ Lufthansa expects to compete in Europe, the British argue, at least until English transport planes are replaced.

West German officials appear very concerned over the report during interviews with Aviation Week.

Lufthansa hopes eventually to increase its fleet to a maximum of 60 to 80 aircraft in the market for which British and American manufacturers are competing in a volatile war.

■ **Turkopolis Interest**—Despite British charges of obstacles, Lufthansa officials say they desire the Conquest and Lockheed aircraft because of their long record of efficient inflight service. Speed of delivery was another consideration.

It is likely that the new Lockheed L-1441 turboprop 8-prop Constellation (Aviation Week Dec. 5, p. 17) will be at least strong German interest for its planned international routes.

The airline will use its twin-engine Conquest for European flights to London, Paris, Rome, Zurich, and other cities. Its Super Constellation will carry service between Hamburg and New York.

The airline hopes within three years to expand its operations to Africa, Asia and South America.

Lufthansa is constructing a large

maintenance base at Hamburg, following a spatual battle between several German cities for the maintenance center. Its initial operations within Germany will serve Hamburg, Düsseldorf, Witten, Frankfurt and Munich. Witten serves both Cologne and Bonn.

■ **Comments**—Cabin-door agreement by the occupying powers provided that only markets of Britain, France, Russia and the U.S. may use the air corridor to Berlin. Lufthansa will not be able to fly into that city—at least for now.

It is not considered likely that the Russians, now operating in alliance with the East Berlin airport of Schönefeld (Aviation Week Oct. 25, p. 124), will approve any change in this agreement, particularly since it would imply a recognition of West German sovereignty.

The East German line, using Rostovsk aircraft, is operating between East Berlin, Warsaw and Budapest. It is expected to extend its operations to Paris, Moscow and perhaps such cities as Stockholm.

The Reds have refused to permit Soviet-made Airlines System and KLM Royal Dutch Airlines to operate into Berlin, unless they use the German-controlled Schönefeld terminal. Their attitude toward Lufthansa undoubtedly will be even sterner.

■ **Newark Center**—Bids of the new Lufthansa network will be Rhine Main Airport in this city, directly the center for foreign airlines operating into Germany. Thousands here and at Rheingau, the nation's commercial center, are modern and efficient.

Once Lufthansa begins operations, probably by Apr. 1, SAS, KLM and Aer France will abandon their domestic routes within West Germany. SAS, for example, has been operating a 10-stop DC-5 Berlin-Germany-Germany—WPC.

Dallas Gains Support In Airport Dispute

The Dallas-Ft. Worth airport dispute (Aviation Week Nov. 29, p. 77) took another turn as Dallas gained some qualified support from the Airport Operators Council in its Supreme Court fight with Civil Aeronautics Board.

Dallas has asked the Supreme Court to remove its case against CAB over Central Airlines' service to Dallas-Ft. Worth. Is the Central request successful, the Board granted the airline a route into Dallas and Ft. Worth but specified that both cities be served

through the single terminal at Ft. Worth International Airport.

■ **Authority**—Dallas decided to go to court as an effort to satisfy the dream.

The city contends CAB did not establish the airport as an asset in the case. The city claims it was denied its right to notice and hearing by the Board's "advisory" action. A lower court decided against the city last May.

■ **Advisory Support**—The Airport Operators Council has filed a statement supporting a Supreme Court review of the controversy. The council does not take sides on the specific issue of the Ft. Worth airport, it believes that the operators involved transcend any local disputes between the city of Dallas and the city of Ft. Worth.

"In the ultimate analysis those parties the question whether, under the Civil Aeronautics Act of 1938, members of the general public are entitled to an amply adequate and deliberate notice of the questions which are to be decided in such proceedings before the Civil Aeronautics Board to the end that they may decide whether or not they will become parties, what evidence they will introduce and how they will conduct themselves in other respects."

CAB Staff Helps Dutch Investigate DC-6 Crash

Two Civil Aeronautics Board staff members are expected to return from The Netherlands this week after leading technical assistance to the Dutch government in its investigation of the crash of a KLM Royal Dutch Airlines DC-6B in the North Sea in August. The crash killed all 21 persons aboard.

Leon H. Taggart, chief of the Technical Division of the Bureau of Safety Investigations, and Murray V. Clark, his assistant, accompanied a Dutch search team at the specific request of the Dutch government.

About 60% of the wreck of the DC-6B has been recovered and is being raised in Amsterdam. Part of the fuselage has been reconstructed with the aid of a representative of Douglas Aircraft Co.

Test Cell Contract

Contract for design of a new test cell at Ansett Engineering Development Center, Tulsa, Okla., to determine what happens when high engine thrusts are introduced into aircraft and high speed has been awarded to McDonough, Hoffman & Associates, Inc., New York, N. Y. Air Research and Development Command, is sponsoring the project only a month (Aviation Week Dec. 6, p. 21), used in identifying the design.

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* * HAPPY LANDINGS WITH GILFILLAN GCA QUADRADAR * *



SAS Sees Swing to Polar Flight

Airline reports early over-the-pole service is below break-even, but experts increase during tourist season.

By William Condliss

Copenhagen-Stockholm Airlines Service has scheduled new polar navigation techniques with the probability of Douglas DC-6Bs to pioneer a commercial air route across the top of the world that soon will be followed by other major airlines.

Early acceptance of the new twice-weekly transpolar flights has been good, SAS spokesmen report, with load factors up to 80%. That, however, is under the break-even point for the 12-passenger DC-6B Royal Viking transpolar.

Northwest Passage—Low load factors were expected during the first winter months of the new service and SAS, in confident traffic will climb rapidly with the approach of the tourist season. Travel agents already have reported a number of customers ditching bookings to the new over-the-pole route.

Beginning with its first Los Angeles

to-Copenhagen flight on Nov. 15, 1952, SAS has closed its new "Northwest Passage" route the cold northern shore. Over the Skagerrak Sea, above the North pole, on a cap at Greenland, down across Hudson Bay and the cold north country of Canada has a new route that brings Europe and the U.S. west coast a thousand miles closer together.

It makes Los Angeles a "gateway to Europe" and the Danish city a "gateway to California."

Direct Service—Trans World Airlines and Pan American World Airways already have shown interest in the trail-blazing efforts of the modern Vikings. Economy in time and distance can be achieved in polar routes between Europe, the U.S. and Asia.

"SAS believes that the route across the Arctic for many reasons promises great possibilities," says K. Flugtag, Stockholm, vice president operations. "People on the American west coast will get a direct service to Europe, passengers avoid tedious circuit changes

in New York, and last but not least, the route has a great tourism value."

► **First Flight**—115 passengers on the inaugural flight from Copenhagen to Denmark Nov. 15 were treated to the premium polar dining and airline service with which SAS hopes to lure passengers from more conventional and less romantic routes.

The Royal Viking Wind from a foggy Los Angeles International Airport at 12 pm, took midnight and arrived at Winnipeg, Canada, 5 hr 30 min, later in clear but cold weather. At the controls for the first leg of the inaugural flight was Swedish Capt. Sten Gibson.

Interiors of the DC-6Bs used on the transpolar route have accommodations for 12 passengers and a crew of 10. There are eight berths available in the aft section and 24 forward "domestic" seats that may be lowered to full reclining position.

► **Pole Path Comparison**—after a brief stop at Winnipeg, the DC-6B headed southeast for Polar West Flight (PW-5), 2,000 mi. away on the west coast of Greenland, with Capt. Ferdinand Beck, 33, ex-Norwegian Royal Air Force, 5 yrs. in command.

Flying at 17,000 ft. with the outside temperature at -59°, the Royal



Swiss Test New Antiaircraft Missile

New version of the Guidolin antiaircraft missile is shown during recent tests at Yverdon in the Swiss Alps. Delta wings replace the trapezoidal surfaces of the original layout (Aviation Week, Sept. 17, 1951, p. 34) and small wingback fins have been added near the tail. Launcher design has been changed up. Manufacture of the missile, Guidolin Machine Tool Works, Zurich & Co., of

Zurich, says the Swiss Army will have priority on production missiles, but that "any Western country" may buy units. A batch of 15 has been tested at the United States at the Ballistics Air Development Center of the Air Research and Development Command, USAF. Guidelines of the refuel model was later used with a speeded range of about 12 mi. No other details are available.

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Viking dived south over Hudson Bay
and crossed the Arctic Circle at 2:52
pm EST.

Next, approaching the North Pole
area, the case of this search began to
wily on its Polar Path computer, developed
by the El Segundo Division of
Bendix Aviation Corp., and upon a new
navigation system and chart.

Navigation in the Arctic is plagued
by two problems:

- Convergence of lines of longitude at the Pole. This was solved with a so-called grid navigation system in which the average calculation of courses from a single longitude, the Gauss-Krüger method.

- Magnetic compasses gone at the vicinity of the North Pole. This problem was less simple. To solve it, Bendix developed the Polar Path computer, a gyro compass which continuously drifts at less than one degree per hour and whose program due to rotation of the earth is compensated for automatically by a device within the compass itself.

- Airborne Radar-Guiding the winter months, SAS also can rely on celestial navigation, since its navigation will be able to take them on the stars. During the coming summer months of daylight in the Arctic, only the sun will be visible, however. Then the Polar Path will be of even more importance.

Airborne radar, using long-range navigation systems, such as Loran or Conical, that employ a network of ground stations for guidance, still is in the future.

The passenger flight headed at the cold and noisy USAF base at BW-4.

Le 13, 14 and other departure times. Warnings. After major time spent for refueling, the Royal Viking dived away from the Greenland base and set out on the final leg—1,162 mi. to Copenhagen.

Weather in the Arctic usually is much better than that of the North Atlantic area. A temporary high circled from eastern Alaska to northern Greenland throughout most of the test.

- Polar Meteorological Data Specialist, commanding officer at BW-4, says the base has "some of the best flying weather in the world." It is below minimum safe 250 ft. limit, he reports. Nevertheless, the Air Force has one of its best GCA towers situated at Sondre Stromfjord and SAS crews are experienced on GCA landings.

No amount of the SAS flight would be complete without a comment on the return.

A typical sail includes Russian cover and guest list; mass of mail; some soap, most food, guns, cheese and crackers, desert and rub over. The south are accompanied by sports, champagne, five white and red roses, after dinner liquor and bananas. The

Facts about HELICOIL inserts in the aircraft industry

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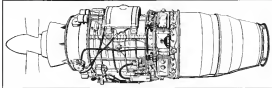
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DERATED TURBOPROP based on Wright's 12,000-shp. T49 (Aviation Week drawing above) would produce 6,000-6,500 shp.

Wright Pushes 'Supercharged' Turboprop

Hurley says derating the military T49 would provide airlines with powerful constant-output engine at slight development cost and time.

By Irving Stone

The derated turbo-prop engine is advanced by Roy T. Hurley as the logical powerplant to speed development and operation of turbine-propeller-powered commercial transports in this country.

Hurley, president and chairman of the board of Curtiss-Wright Corp., told Aviation Week that studies at the company's Wright Aeronautical division indicate the feasibility of using a

derated version of an existing high-power turbo-prop engine in place of the future models of Lockheed Super Combs and Douglas DC-7 series.

- **Benefits of Derating.**—The derated version of a high-power turbo-prop is now offering three advantages:
- **Constant power availability from sea level to operating altitude.**
- **Increased block speeds.**
- **Increased average two miles per year.**

► **Big saving in development costs** usually involved in bringing an engine

from scratch to a status comparable to that of the derated turbo-prop.

- **Increased reliability and durability.**
- **T49 Studies.**—Wright's studies already refer to a derated model of the T49, the military turbo-prop based on the company's 16,500-horsepower. More than 5,000 of the T49s have been built.

Aviation Week revealed the installation of the T49 in Boeing's 707-420, in combination with the General Electric J47, the plane's normal powerplant (Apr. 16, p. 34).

Full rated power of the military T49 is approximately 16,000 shp. The derated version for commercial application initially would be in the band somewhere between 6,000-6,500 shp. From this derated value, the engine would have a power potential up to its full rating, but this, of course, would mean some redesign or modification of the airplane using the engine to take full advantage.

The derated version of the T49 probably could be ready for delivery for airlines as early as 1958.

- **Constant Power Advantage.**—Wright engineers point out the philosophy in advancing the use of the derated turbo-prop for commercial transports.

With the conventional turbo-prop engine, designed for a certain top power which it is expected to use at takeoff, the horsepower falls off with altitude as a result of reduction in air density. It would be desirable to take off with a power value which normally could be maintained over a fairly wide altitude range.

Starting with a high-power turbo-prop—a military engine, for example—derating it to a desired power value results in a horsepower vs. altitude graph which is essentially similar to that obtained with turbine supercharged reciprocating engines in use today.

Thus, if a turbo-prop that is initially designed to deliver about 16,000 hp at takeoff, is actually derated to provide only two-thirds of that power—6,000 hp—the air-lifting capacity of the base full-rated engine will permit the 6,000 hp to be maintained to an altitude which will allow complete utilization of the aircraft's speed capabilities at that height.

- **'Supercharged' Turbo-prop.**—In effect, the result is a "supercharged" turbo-prop with more thrust capability than required. This means that a smaller, lighter gearbox may be used, coupled to a lighter propeller.

It is estimated that the lighter reduction gear in the derated engine will save about 1,150 lbs. in weight of the full rated engine gearbox.

Another big advantage area for the derated turbo-prop is on hot-day takeoff, a condition which normally may be critical for the conventional turbo-prop or turbo-jet.

With the derated turbo-prop, the derate could be advanced to obtain the total horsepower, despite outside temperature effects, with the conventional derating engine, opening the throttle full effect, may then be the sea level rating on hot days.

- **British Activity.**—The principle of the derated or supercharged turbo-prop is not new. British engine designers have been working along these lines for some time.

British Aerospace Co. Ltd.'s B.E. 25 (Aviation Week Oct. 25, p. 11) is in effect a derated engine, with a large air-lifting capacity not actually needed until altitude is reached. Based on the Bristol Britannia transport, the engine is expected to maintain about 3,500 shp in excess than 20,000 ft of altitude.

Because the B.E. 25 is a "design from scratch" powerplant, it is likely that weight reduction will be brought about which would not be readily available in the normal high-power turbo-prop derated for transport service. However, a derated engine could be fitted to an existing aircraft, if commercial sales warranted that additional development expense.

Another British supercharged turbo-prop engine under development is a 14,000-hp powerplant with a 3,500 shp rating maintainable to about 20,000 ft (Aviation Week, Dec. 6, p. 11).

- **Lower Heat Stresses.**—The high-power turbo-prop derated for transport service will have increased flexibility, hence

Roy Hurley States . . .

Case for the Derated Engine

New engine development has proved to be a very expensive proposition, with long periods of the time involved and many mistakes to be solved before operating hours are accumulated.

Roy T. Hurley, president and chairman of the board of Curtiss-Wright Corp., is an engine advocate with Aviation Week, has emphasized the feasibility of the derated turbo-prop for transport use.

Hurley points out that if a new engine was designed today it would have the same general characteristics as the derated turbo-prop. In effect, this opens a new approach to engine design, one stressing the maximum transport rather than as required to operate at test conditions efficiency.

As Hurley sees it, the engine builder shows his true genius for more power by the engine builder. Now for the first time, there is an issue of power available—more than actually is needed. For this reason, a little less propeller efficiency might be accepted as greater operation, lower engine operating temperatures, with lower stress levels and lower costs because of improved reliability and increased payload capacity.

Hurley points out that this is Wright's derated turbo-prop only has been limited to the economics of a plane which is the overriding factor in the lower engine and DC-7 using such an engine and the modified engines involved with the powerplant.

Performance linked to, Hurley says, a block speed in the neighborhood of about 470 mph, for an economical time of under six hours. The plane with the derated turbo-prop also would be suitable for transoceanic flight—its duration of 3,000-3,500 mi.

Although the estimated cost is between \$25,000 and \$30,000 ft. The plane designer should be cautious in going to high altitude—making for the ultimate too soon. Hurley believes that altitude



HURLEY

increases should be taken in reasonable steps. The derated turbo-prop, he says, could only not efficiently be reduced to meet any airplane, with a minimum reduction of risk to the operator on the way of its ability.

The engine may introduce about 200-250 lb. increased weight per engine as standard, but this would be offset by the higher speed and shorter flight time. Hurley concludes: In addition to the speed derating, there would be a major increase in revenue ton-miles per year, which means more profits for the operator, he points out.

Modification of the wing, or a new wing, would be necessary to take care of the higher power and efficiency necessary for higher speeds.

A new structure would be required, but the derating of the derated turbo-prop could be accomplished in that required for the existing Wright Turbo Combs engine, now in wide transport service.

longer engine life. This results because derating is accomplished by operating the engine at a lower temperature—perhaps in the region of 100° less than that of the full-rated engine.

This would indicate that rearing in excess, high temperature allows could be obtained with the derating scheme that is not likely that the approach would be followed, because of the desire to retain a high safety factor and to eliminate high re-development costs involved.

The derated engine also would be operating at lower stress levels—as an

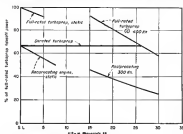
important factor in engine reliability.

- **Prop Modification.**—Still another development is that propeller activity factors and speed level could be reduced. This would be accomplished through modification of blade form and by speed.

This propeller change a derated propeller on the base that, in the derated engine, it is not necessary to operate the ultimate efficiency out of the wing.

The propeller for Wright's version of the derated turbo-prop already has been built and is in use for this application.

The smaller, lighter gearbox for the engine now is in the design stage.



POWER-ALTITUDE RELATIONSHIP indicates low derated turbo-prop, like a supercharged engine, would maintain itself power to high altitude.

Engineers Get Key Jobs, Survey Says

The engineer is a leader in industry, active in community affairs and interested in the classical arts, says Statens Institute of Technology in a result of a survey of that college's 5,500 living alumni.

A total of 67% of Statens graduates are now in policy-making or decision-making posts in industry, the survey shows. Limited to the graduates who have been out of college for five years or more, that percentage jumps to a total of 75%.



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Statens' own figures confirm other recent surveys which have shown an increasing number of engineers called on to fill top industry jobs.

Other jobs almost unobtainable at the graduate are working and doing well in fields outside basic engineering, such as banking, insurance, government, medicine, dentistry and the clergy. Even though this group makes little use of its engineering education, almost all of its members say that if they had it to do over again, they would attend an engineering college. The approach they learned to analyze problems has given added to their chosen professions, they say.

A warning on the engineering short age in it affects the newer industries such as aviation and aviation is contained in the survey.

Says the report, "New industries do not close on the entire majority of engineering talent (even for supervisory personnel).

"Instead, they seem to depend largely on new graduates to staff their engineering and research departments. Therefore, as the supply of new engineers remains below the demand for the years immediately ahead, not all industries will find the pinch equally."

"These habits of affairs must be the newer industries, many of which rely heavily on engineers to develop new products and practices to make use of recent scientific discovery."

Increases College-A, just after graduation, 10% of Statens engineers are earning more than \$5,000 annually after 15 years, 43% top the \$16,000 mark. By retirement age, 10% of them earn over \$18,000 annually.

About one-quarter of the group had they actively participated in music, drama, painting, sculpture or writing. Many have held the group and they take part to one extent the Statens survey reports.

Double-Shell Hull Called Noise Shield

A double-hulled hullage may be a design feature of future commercial air transports, say Douglas Aircraft Co. engineers M. M. Miller and Raymond Pellock.

Major reason for the unusual design is noise reduction, the two Santa Monica division engineers told members of the Acoustical Society of America at the 46th annual meeting at the University of Texas.

Executive Noise-The Douglas don claims that some turbulence loads for the passenger will be exceeded if conventional design is not taken into the structural design of the cabin. Available evidence indicates that there will be no significant reduction of noise at the source.

Thus, the attack on the problem must center around the hullage for the moment, say the engineers.

Douglas had designs and patents on double-shell structure for the DC-3, but never tried the idea because production costs, detail design difficulties and the extra weight added outweighed the real need for the design at that time.

The engineers said that noise reduction, bought for the lowest possible price in weight, permits an expensive and challenging problem for the aircraft industry.

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FIRST TWO STAGES of 3-stage satellite ferry would be jettisoned for recovery.

New Light Cast on Space Flight

By David A. Anderson

The sixth annual convention of the American Rocket Society, held in conjunction with the American Society of Mechanical Engineers, drew bigger and better and the quality of the presentations was remarkably high.

During the three-day (Nov. 30-Dec. 2) meeting in New York, 34 technical papers were presented. In essence, they covered the field, from component design to a concept proposal for a three-stage satellite ferry vehicle.

Space flight attracted the most attention, two sessions were devoted to the subject.

Highlights from some of the more significant papers are presented in the following columns.

► A Preliminary Design Study of a

Three-Stage Satellite Ferry Rocket Vehicle with Packed Recoverable Stages—by Everett C. Rowan, Rockwell International Corp., Alton, Ohio.

An orbital satellite system, in which the first two stages are jettisoned and can—after leaving the payload—glide to a landing at accessible airfields, appears to be a superior system for regular space two between Earth and a satellite orbit.

Each separate vehicle has delta wings and a set of nose doors which close after jettisoning of the stage ahead of it. The supersonic booster stage then becomes a glider and returns to a landing base, where jet pods and other parts are installed for the flight back to the launching site.

In this, the largest and most complex paper at the AAS meeting, the authors do not recommend that such begin immediately. They emphasize

that the current state of the art does not permit that to be done. They do recommend that studies begin, and tests be made on smaller vehicles jettisoned into an orbital program with space flight as a final objective.

Logistics and resources are considered for the system, and the data indicates that the system is superior to other orbital ideas in those respects. There is a significant advantage, for multiple emergency, lack of which has been considered in other proposals.

The feasibility study is a long-range research and development program, not aimed at the generalization, but starting with unmanned vehicles and manned rocket research aircraft and ending with the data necessary to begin the big task.

► High-Altitude Launching of a Small Orbital Vehicle—by Kurt Seifling, Bell Aircraft Corp., Buffalo, N. Y., and R. M. Mason, University of Iowa, Ames, Iowa.

A large phalanx balloon is proposed as a carrier for the launching of a three-stage satellite vehicle carrying a 50-lb. payload.

The experience of the Redstone launching of Skyward balloons and Discover rockets—had the vehicles to look at a somewhat more sophisticated system for placing a small payload in a satellite orbit. The big saving is manhandling drag, because the actual launching takes place at 75,000 ft.

A three-stage vehicle could be built for an extended 13,500 lb., and would orbit the payload in an orbit at altitudes up to between 300 and 360 mi.

► Instrumentation for Space Vehicles—by George W. Howell, Office of Naval Research, Washington, D. C.

The general discussion is concerned primarily with the utility of an unmanned orbit satellite. Useful, or not, I am sure of one thing—if we get our unmanned satellite, someone will soon decide to cut a hole in it, pull it out a cockpit, and study a man in it. My main interest is to see that this is a rocket that will be designed to consider the characteristics of the man before it is built, not afterwards.

With this perspective in mind, however, let us discuss a discussion of some of the problems of manned space flight instrumentation.

Typical is the altitude problem. "Will it be feet, thousands of feet, miles or some new dimension?" There are three factors to consider: How well altitude be measured, how well it be indicated and with respect to what?

"I hope that some of you will start thinking about these problems now instead of waiting until recently registered sessions of association."

► Helicopter Logistics—Don W. Ricket,



THE Air Force is faced with an important need: a winged target which will simulate jet-fighter evasion maneuvers—provide realistic aerial gunnery training for pilots flying at near supersonic speeds.

Goodyear Aircraft, working closely with the Wright Air Development Center, has designed and built such a target: the 1400-pound all-metal target shown here, which combines the desired features of realism and returnability.

It can be flown at high altitudes at speeds in excess of 500 m.p.h., offset to one side of, and as far as 2 miles behind, the tow ship.

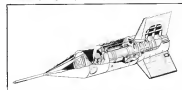
It can be made to perform evasive maneuvers either automatically or by direct control from the tow plane.

It is equipped with landing skids and a cable-release device which permits repeated use until the target is "all shot."

It is an interesting example of the cooperation, design abilities and production skills which have made Goodyear Aircraft Corporation "The Team To Team With in Aeronautics."

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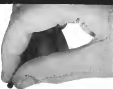
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RECOVERABLE MISSILE was specially designed for high-speed tests of space tests.

New kind of fuel level switch

Honeywell
develops new
use for its
thermistors



Now the thermostat, stored their state of vacuum tubes, make their the spotlight with modern semiconductor—the thermistor.

The thermistor is a rugged, inert, ceramic-like resistor whose resistance changes precisely as the temperature changes.

Honeywell has put it to work in a new kind of fuel level switch.

The Honeywell Thermistor Level Switch has many uses. On the B-47, it warns in a high level switch to prevent fuel spillage. Whether on the air or on the ground, overflow is wasteful and extremely hazardous. It can be used as a low level switch to automatically sequence fuel in series of gravity control operations,

act as a safety switch to prevent fuel pumps and openers low fuel warning lights.

Potentially, thermistor-controlled devices can be used for temperature measurement, control and compensation, as most delay devices and for level sensing in any type liquid.

The Thermistor Level Switch has an moving parts and is, therefore, far less subject to mechanical failure than previously available switches. Shaking doesn't affect it, it is simple to install and it has a longer, more dependable life.

Write for full information on your business interests to Honeywell Aeronautical Division, Dept. AF-13251, Minneapolis 15, Minn.

Meridian Corp., Baltimore, Md. Hydrazine, a rocket fuel cable either as a monopropellant or in combination with an oxidizer, is now available in storage quantities.

That's exactly the variable new element was produced on a small scale as a high-priority research item. Rocket scientists thought it would be a valuable addition to the program if it didn't cost so much, and the manufacturers thought it could be produced for less if there was a big sales potential. Neither side made a move for a long time.

Now Meridian has brought into production a commercial plant at Little Chalkley, Ia., because of hydrazine's value to the rocket program and because of the commercial possibilities of the chemical.

For material prices is good, there appears to be a lower dollar price limit of about one dollar per pound. It is shipped in 55-gal. drums.

Infinite Corrosion Corrosion chemists the substance as a "corrosive liquid." Operators using the material should wear protective clothing, should flush the skin with water if there is any contact with hydrazine, and should remove and wash any clothing on which the material is spilled.

► **Methods for Endoconcentrated Turbine Rocket Engines—**By Larry Meller and Eric Harlick, Reaction Motors, Inc., Kalamazoo, N. J.

What are the economic and methods available for simulating the various environmental factors affecting the performance of rocket propellants? The authors consider temperatures between -100° and +2000°; altitudes to 100,000 ft., and humidities to 100% in the entire range to study.

Liquid propellant require a conditioning unit specially designed, but solid propellants can be tested in its place. By using a cheap hot and cold chamber, or by using a condensation tank.

Components for propellants are separated into two groups. The commercial environmental chamber will handle one group, but the other—most of them in complexity—must be handled in special equipment, perhaps expendable.

Rocket engines can be handled in the same way as components, but the authors show that an expendable chamber used in conjunction with a propellant conditioner and a quiet condenser is the most practical approach.

► **Supersonic Component Test Methods—**By Donald L. Anderson, Walcott Industries, Inc., and Harry Wurst, Cook Research Laboratories, Chicago. Skates and Chakras are two animals developed to test supersonic



The Flexbelt Valve can be used with all three-phase electric circuits. It features a valve body made of stainless steel. A pilot solenoid valve is mounted on the side. The valve is designed to operate at pressures up to 1000 psi and at temperatures up to 1000°F.

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The Flexbelt Valve is designed for fast remote control of flow media on high-speed aircraft. It handles large flows and controls high pressures over a wide range with low power requirements.

Pressure of the flow medium holds the Flexbelt Valve member (Teflon-impregnated glass fabric) tightly against the orifice opening, thus sealing off flow completely when the valve is closed. Flow is controlled by rolling the Flexbelt onto a concentric mechanical drive, thus peeling the belt away from the inside surface of a cylindrical seat. The valve seat, Flexbelt, and valve shaft form a sub-assembly permitting change in the valve flow characteristic by replacement as a unit.

Specific applications of the Flexbelt Valve include remote fuel flow control in aircraft fuel systems and control of maximum exhaust gas temperature by variation of fuel flow to a turbine engine.

We believe our long experience, extensive facilities for developing, manufacturing and testing control system components for high-speed aircraft can be helpful to you. Our engineering counsel is at your service. We welcome your inquiry.

SPECIFICATIONS — Flexbelt Valve Type 147M

FLOW MEDIA: Water, glycols, kerosene, oil, etc. and gas. **FLOW MEDIA TEMPERATURES:** Minus 60° to plus 350° F. **FLOW RANGES:** Up to 25 gpm of water at 25 psi pressure drop. **FLOW CHARACTERISTICS:** Linear, non-linear, logarithmic, differential pressure. Up to 1000 psi maximum. **OPERATING SPEED:** 2 seconds from full open to full close. **VOLTAGE:** 110 or 50 cycles at 60 or 400 cycles. **POWER:** 12 watts maximum. **PERFORMANCES:** Flow 3-30,000 cfm at various sizes. **CONNECTIONS:** ANTI-SUCK-BACK to meet ANTI-SUCK-BACK to prevent backflow. **MATERIALS:** Housing — light weight aluminum, explosion proof. Valve — stainless steel. Shaft — stainless steel. Flexbelt — Teflon-impregnated glass fabric. **WEIGHT:** 10 lbs. **SIZE:** 2" x 3/4" x 4".



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parameters and other components at high speed in free air.

Unlike most missiles, the require exactly the three test vehicles mentioned a high-drag design, after test component, but frictionless, the high drag and the recovery of the missile for re-use because it slows the vehicle down.

Stage 1 was an unpowered vehicle intended to test parameters of high release speed in free air, a dynamic pressure of 400 psi had to be sustained at 20,000 ft altitude. Tests made with Stage 1 resulted did tests made on parameters, and served as a prototype of a supersonic powered vehicle.

Stage 2 is powered with three

11,000 lb thrust, Ramjet units. As launched, it should reach about Mach 2. The design is still under development.

Glennville was specifically designed for reaction test tests, using a full-scale test and recovery vehicle at speeds up to Mach 15 at 20,000 ft. Power came from a solid-propellant rocket tested at 51,000 lb thrust for three seconds.

Two tests have been made both were successful, and in both cases, the parachute recovery did not work. But the second test system test was completed satisfactorily.

► **Rocket Simplification With Multi-Function Components**—By Bernard

Ellis, Reaction Motors, Inc., Rockaway, N. J.

The rocket programmer, originally starting out as one of the least complex units ever conceived in the history of the space age, has become a complex. This complexity is excessive in the majority of applications and reduces system reliability.

RMH has a program for system simplification by using multi-function components, built around these three principles:

- Eliminate all unnecessary functions.
- Supply the hardware that is used to accomplish the remaining functions.
- Eliminate parallel independent functions in the procedure.

Following this program gets a designer into the position of specifying relatively uncomplex systems for which there are no available components. In this field, there is a need for alternative means applied in such problems as those involving, moving, starting, transmission, propulsion, and gas supply.

► **Development of a Stabilization System for the Viking Rocket**—By N. E. Fick, Jr., Glenn L. Martin Co., Baltimore, Md.

Three separate sub-systems are required to solve stabilization problems of the NGL-Martin Viking research rocket.

Main control is used by allowing the line of thrust of the rocket engine. Asymmetrically, will control into available tabs on two of the four fins. Small jet nozzles give a thrust reaction for control.

The last two systems were designed on the basis of frequency response techniques, but the last required the use of automatic computers and non-linear systems.

Martin says the basic approach was sound. But the first two things have shown the need for greater reliability, easier adjustment, and interchangeability, especially during the early phases of the program.

► **Performance Analysis of Short-Range High-Velocity Ballistic Rocket**—By W. O. Beynon and L. M. Miller, North American Aviation, Inc.

The short-range ballistic rocket must commonly be applied to tactical systems in support of ground units. No guidance is used. The relative velocity between launcher and target is high, and there must be a short flight time.

The specific application plays a large part in determining the optimum control algorithm and the parameters which are usually important may not be important at all in this kind of rocket.

It is possible to eliminate drag terms in calculating time-to-target, and thus get more optimum propulsion system

Lead Flexible Couplings Blies With Kaman Helicopter

The Kaman K-5 helicopter presents an interesting application of the LORD J-3329-2 flexible coupling with the Boeing 500-2 gas turbine. The function of the coupling in this case is to absorb the torsional vibrations of the system and isolate the turbine from the rotor. However, the unit also serves to accommodate angular or parallel misalignments due to manufacturing tolerances or dynamic motion.



The unique design of the installation provides maximum accessibility and economical maintenance through the use of concentric driving and driven shafts. The inner member of this pair is the engine shaft which drives the coupling hub through a splined connection. Pre-compressed against the splined hub are the two bonded rubber coupling halves which transmit the engine torque to the rotor. Four through-bolts connect the outer plates of the coupling halves to the driven hub and also serve as the safety device to ease the rubber sections are destroyed. The first gear of the transmission is mounted on this driven hub and leads power on through the system to the helicopter rotor.

For over thirty years the Lord organization has specialized in designing and producing Bonded Rubber Flexible Couplings, Vibration and Shock Control Mountings and Component Parts. The experience of Lord Engineering have proved their worth to designers of industrial and automotive equipment in many diversified fields as is indicated in this instance.

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HERE again you see at a glance Lord versatility in designing bonded-rubber components for a wide diversity of machines. The photo at top right shows the Boeing Gas Turbine-Driven Turbo-Transfer for heavy cargo handling. At the top left you see a United States Navy personnel boat driven by the Boeing Gas Turbine Engine. Directly beneath is the Kaman Helicopter powered by the Boeing Gas Turbine Engine. Details are clear in the foreground. The Lord Bonded-Rubber Flexible Coupling designed for the job transmits the power in each machine.

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configurations even though the effects are not 100% accurate.

The specific applications also affects the type of analysis to choose.

► **Supersonic Research Slots and Truck Facilities**—By F. W. Thiele, North American Aviation, Inc., Downey, Calif.

The use of rocket-propelled slots during on-rails at high speed has been a highly successful test procedure. Full-scale test specimens can be "fired" through the transonic region to speeds as high as Mach 2.0.

Slots, nozzles, ejectors and expanders can be fired out of moving vehicles under controlled conditions in any desired direction with respect to the jet.

This paper covers the types of slots, powerplants and truck facilities currently in use in the United States, and presents some of the recent claims of tests and results from these tests.

► **The Top Radar Target**—By Gilbert Moseley, New Mexico College of A&M, State College, N. M.

Use of a radar-reflecting, high-velocity target for guided missiles, consisting of a parachute with a ballistic silver coating and a rocket to carry it aloft.

Missiles descent rate does not exceed 1,500 fpm, and maximum dash speed rarely exceeds 100 mph. Even if it is nearly a stationary target, and considered as an addition to the target force, rather than a substitution.

Lockheed to Award Scholarships to 15

For the third year, Lockheed Aircraft Corp., will award five-year college scholarships to 15 high school seniors who want to study engineering as a business occupation applicable to the aircraft or missile industry.

Full tuition and fees plus \$500 for personal expenses will be paid by the company to students with "demonstrated or potential leadership."

Two of the given are for engineering majors and the other five would apply to the study of business administration, accounting or industrial relations.

Scholarships are open at Massachusetts Institute of Technology, California Institute of Technology, Georgia Institute of Technology, North Carolina State College, Research Polytechnic Institute, University of Michigan, Georgia Institute of Technology, Case Western Reserve University, Stanford University, Harvard University, Emory University, Penn State University, Northwestern University and San Jose State University of California.

Each participating college will get a \$500 grant from Lockheed to aid in administration of the scholarship.



SWIFT F-3 FIGHTER is locked up to engine starters and secured by start bars. Note Swift's suspended landing edge wings, vortex generators atop right stabilizer only.



UPPER EXIT of jet engine nozzle behind the pre-heat ducted, round bypass. When afterburner is not used, conversion is possible right up to the pre-heat.

Jet Muffler Hushes Swift Tests

"Remarkable success" is credited to a new outdoor muffler used by Vulcan Armstrong, Ltd., to hush the roar of Swift jet fighters being run up on the ground prior to flight.

Construction on the firm's South Maestri factory premises was extremely difficult when the Swift's Ball Room Area was given full throttle. When the afterburner was turned on a loud roar was heard.

► **Engine Noise**—Following installation of the new muffler and place enclosure, mainly negative replies were given that engine noise was quieted down after the engine had been run normally. The noise heard when the afterburner was used was not associated with such a test.

Vulcan Armstrong is convinced that the noise level can be reduced further.

► **Muffled Muffler**—The muffler is made from several sections of a silencer normally used with jet engine test stand installations. Designed by Jack Collins, managing director of Detcon, Ltd., London, the muffler is about 45 ft long, compared with the 50-60 ft length of a typical silencer.

The open part is 12 ft. 6 in. high and completely encloses the place. Wall sections are lined with sound-absorbing material, as are the vanes of the two steel sliding doors. Swifts built into the walls protect maintenance personnel from the noise.

An additional benefit of the test is that in the jet engine is taken in from the atmosphere above the enclosure, making contamination the powerplant with steam and dust which might otherwise be drawn in.



Q-U-I-C-K engine change nuts servicing have end seats on the Republic F-84F Thunderbolt, newest, fastest member of a rugged family.

Aeroquip 3,000 p.s.i. Self-Sealing Couplings, standard equipment on the F-84F, allow disconnecting of all hydraulics, pneumatics, fuel and oil lines in minutes, without draining. When the replacement engine is installed, tests are accomplished without air entering the fluid systems.

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Arrowhead, designers of Fiberglass covered sponge rubber seals, offer a complete line of resilient compressions seals for engine firewalls, ballistics, compartment and hatch sealing and other special uses. Fyre-tite seals withstand a 2000° F-15 minute drop and can seal against temperatures from -125° to +500° F. Frigi-Flex seals combine resiliency and flexibility at under daily life in extremely low compressions with exceptional toughness and chemical resistance. Both Fyre-tite and Frigi-Flex seals are light weight, resistant to heavy compression and are in rugged form.

Twenty seven basic structural configurations in five standard shapes meet most special requirements; custom made shapes and materials for special projects.

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PRODUCTION BRIEFING

► Shift of high priority materials to speed nightjet B-57 bomber production is being undertaken by Boeing Seattle in supplying second-source Wichita plant with close-schedule items such as master tools, production parts or engineering material whose delivery delays would prove critical. C-97 Stratofreighters are used.

► One-half-inch Mighty Mouse rocket has been delivered in small lots by Brown Manufacturing Co., 2561 E. Colorado St., Pasadena 4, Calif. Mighty Mouse is 2.75 in. folding fin aircraft rocket.

► New engine muffler facilities for quieting jet engines at Cessna's Moogville plant, have reduced sound volumes reaching nearby communities by approximately 15-20 decibels.

► Lusk, Inc., is conducting expansion at Santa Monica, Calif., Airport with two main buildings, providing a total of 65,000 sq. ft. floor space under construction. A 20,000-sq. ft. structure will house heat treating, plating and other new equipment. A new 40,000-sq. ft. hangar and office building awaiting completion will support Lusk's aircraft engineering division facilities for producing Learjet business planes.

USAF Contracts

Following is a list of recent USAF contracts awarded by AFMC:

- Boeing Aircraft Corp., Wichita, redesign of B-52A wing tip of B-52D wing, lot 2, 100,000 sq. ft., \$100,000.
- General Electric Corp., San Pedro, Calif., research, repair, overhaul, 250 ac. of B-52, lot 2, 100,000 sq. ft., \$100,000.
- General Electric Corp., San Pedro, Calif., research, repair, overhaul, 250 ac. of B-52, lot 2, 100,000 sq. ft., \$100,000.
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- General Electric Corp., San Pedro, Calif., research, repair, overhaul, 250 ac. of B-52, lot 2, 100,000 sq. ft., \$100,000.



STATIC TEST RIG is hooked up to Toledo scale to measure thrust. Thrust shows 10 lb.

How Hiller Tests Tiny Ramjet

An extensive development and test program lasting five years was necessary before Hiller Helicopters, Inc.'s little HRJ23 rotorship could meet company and CAA specs.

The engine has passed a 100-hr. test on the test-bed with an acceleration rated as 40 GAA type certification test of its kind to be granted.

The HRJ23 is a complete unit consisting of a diffuser, flameholder, combustion chamber and exit nozzle. Body is made up of shell segments fastened from the front, welded to a heavier mounting plate forming the engine's reduced center section.

Thin plate ingers in section and provides a thick central base to which the rotor blade attachment hub is welded. Inlet is forced by an inner liner forming a diffuser and the rotor is mounted by a thick collar welded to the shell segments. A radial, forward-facing lip supports flameholder is located centrally in the exit section of the diffuser.

Partnership: Length 21.3 in.; max diameter 5.4 in.; weight 12.7 lb., 45 hp.



MOHNET COPTER tests engine shell



RAMJET is mounted on thrust activity



WIND TEST RIG has been used for well over 2,000 hr. of high speed flight



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Model 48120 is available in a wide range of sizes and materials.



MODEL 48120

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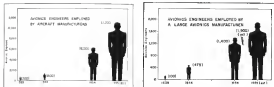
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PERCENTUAL GROWTH OF AVIONICS SEGMENT of avionics industry (graph at left) evidences the corresponding growth of the aircraft industry itself, as testified by number of engineers employed by one large avionics manufacturer (right).

Aviation Week Survey Shows:

Airframe Avionics Is Fast-Growing Giant

By Philip Klein

In 1990, electronics/electronics engineers in aircraft plants were so rare as to be almost an oddity. Today, U.S. avionics manufacturers alone employ more than 6,200 avionics engineers and the figure may top 11,000 by 1995, an Aviation Week survey indicates.

In 15 years their numbers have tripled, as the number of avionics engineers in aircraft industry grows. Today, almost one out of five engineers in an aircraft plant is engaged in avionics activities. These figures do not include an estimated 1,500-2,000 avionics engineers employed at Hagler Aircraft Co., which now considers itself an avionics rather than an aircraft manufacturer.

The acceleration over the growth of the avionics industry during the past 15 years, which itself has been phenomenal. For instance, one major avionics manufacturer had a 1,500% increase in avionics engineering staff during the same period. During the next five years, the manufacturer anticipates a 35% increase in avionics staff compared to an 8% increase expected within the aircraft industry.

The AVIATION WEEK survey also shows a healthy amount of avionics research and development within avionics companies, stretching of competitive significance to all established avionics manufacturers.

► **Why the Growth?**—This phenomenal growth reflects the greatly expanded role of avionics equipment in aircraft, and the new equipment in the last major aircraft sold 1980, two years ago only a handful of avionics

engineers were needed to lay out the simple electrical/gas turbine system and plan the installation of the radio direction finder and communications equipment, just about all the aircraft equipment arrived on board.

Today, however, bombers, interceptors, and fighters are jammed with avionics equipment—radio for control, electronic countermeasures, navigation computers and various onboard photo and stable, instruments in addition to communications equipment. Most of this equipment must be carefully engineered, built and integrated with the aircraft for optimum performance.

General aviation engine even more

engineers demands for integration of avionics, powerplant and avionics which is reflected in the higher percentage of avionics industry avionics engineers who devote their efforts to avionics.

AVIATION WEEK's survey shows that 55% of the aircraft industry's avionics engineers are working on engine, 45% on related aircraft, the remainder on avionics-related.

► **"Creeping Avionics-ism"**—Avionics manufacturers have been aware for some time of what at least one of their calls "creeping avionics-ism." In certain segments of the aircraft industry, avionics Wren's survey reveals quantities much for the first time the extent of avionics industry avionics.

One significant outcome of this pattern that threat to the established avionics industry is the number of avionics engineers engaged in avionics research and development within their own labs as compared to those engaged in installation, engineering or engineering development by outside vendors. These R&D activities will spawn the new ideas, devices, and systems which are compact with the established avionics industry. In some instances this connection already exists.

► **R&D Activities**—The AVIATION WEEK survey shows that the following percentages of avionics industry avionics engineers are engaged in R&D activities:

- 35% combined average for all avionics engineers
- 45% of those engaged in quoted avionics work
- 20% of those engaged in quoted avionics work
- 10% of those engaged in quoted avionics work

Exclusive Report

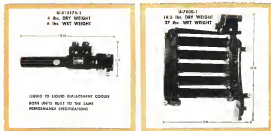
For several years the avionics industry has witnessed with some apprehension the growing staffs of avionics engineers employed by aircraft manufacturers and the increased activity of avionics companies in the field. Now for the first time, AVIATION WEEK is able to detail the growth and scope of this development, as shown by analysis of an industry study conducted by this magazine.

Accordingly, this is the first time it shows how much avionics is doing in avionics, as well as avionics factors which may tend to limit such penetration based on conventional avionics. AVIATION WEEK's Avionics Editor Philip Klein has held with both avionics and avionics manufacturers.



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IS THE ARCON AN AIRCRAFT? No, but it is the next best thing to an autopilot, especially when you are under pressure to do something else, such as avoid gas, encounters, or just plain relax.

IS IT A SUBSTITUTE FOR AN INSTRUMENT RATING? No more than a life-preserver is a substitute for knowing how to swim. However, the Arcon could save your life if you were inadvertently caught in "weather," and it will ease the burden of the qualified instrument pilot who deliberately chooses to fly instruments.

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IS IT INSTANT APPROVED? The Arcon will soon be offered as factory installed equipment by most leading aircraft manufacturers.

IS IT PROVE APPROVED? Ask any pilot who has had an opportunity to fly it. You will soon find very few pilots who will fly without it, because it makes an airplane fly the way it should fly—automatically. The Arcon is here now. See it. Fly it. Discover how it "marks a new era of safety and utility" for you!

Give your nearest Lear distributor or write for full information to Lear Inc., Lear-Cel Division, 5075 S. Bundy Drive, Santa Monica, California.



ARCON means Automatic Rudder Control



PIE CHARTS SHOW how avionics industry (aircraft and missiles) looks in, at its most electrical/electronic segments.

to wide breakdown of avionics engineers' activities for those engaged in pilot-aircraft operations indicates that most are performing in-house R&D for the engineering departments concerned from the outside sources in design. However, the last's share goes into installation engineering. The breakdown for piloted aircraft is:

- 30% developing equipment in own labs
- 13% supervising outside vendor developments
- 47% in installation engineering
- 10% in flight test and instrumentations

• 5% miscellaneous.

Because some companies consider this, one of their engineering staff categories, installation, Avionics Week volunteers not to allow breakdown for individual companies. However, the survey indicates that the following devote a substantial percentage of their total pilot-aircraft avionics activities to in-house R&D: Convair, Dyna, Northrop, Ryan, Bell, and Republic. Companies at the other extreme include McDonnell and Texaco.

Breakdown for Missiles—A corresponding industry-wide breakdown for missile engineers in similar kind

shows some significant differences. For instance a much higher percentage of total effort is devoted to in-house development, much less to installation engineering. Here too, the survey agrees with corresponding aircraft figures shown in parentheses for ease of comparison.

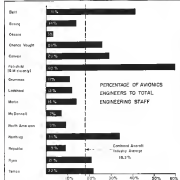
- 49% developing equipment in own labs (33%)
- 14% supervising outside vendor developments (13%)
- 29% in installation engineering (47%)
- 9% in flight test and instrumentations (10%)
- 2% miscellaneous (5%)

Companies which devote a higher five average amount of avionics staff activities to missile in-house development include Convair, Ryan, Dyna, Ford, and the Grumman Missile Division, and Texaco, the survey indicates. General Motors, Convair, Northrop, and Ryan are below average on this score.

The lower percentage of effort for installation engineering reflects the fact that most avionics equipment is tailored to its specific missile during its development and that there are few, if any, standardized equipment furnished by the government to GFE (government furnished equipment).

The higher percentage of in-house R&D reflects the thinking of some missile makers that this approach permits better integration of avionics and missile, when the latter's performance and configuration are subject to frequent changes. (There are contrasting arguments on both sides of this issue.) However, in production emphasis is on in-house R&D to avoid (with few higher avionics content), regular in-house manufacturers seeking to maximize their share of the available market profitably can be concerned over the high percentage of in-house avionics development in surface plants.

Consolidated Breakdown—A consolidated avionics industry breakdown of avionics engineering activities for both air-



NEARLY 1 OUT OF 5 engineers employed by avionics industry is in avionics.

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WASHINGTON, D. C. • E. E. Swenson
2000 Massachusetts Avenue, N. W.—(HOLden 3-4115)

DETROIT, MICH. • Old Industries Company
11440 Argonaut Avenue, Green Park 36, Mich.
(Tolando 3-7804)

GRAND RAPIDS, MICH. • The Lyle Company
421 Lyon Street, N. E.—(Glendale 4-3243)

INDIANAPOLIS, IND. • Jack Dumas & Associates
121 West 26th Street—(CLinary 3590)

WICHITA, KAN. • D. & O. Engineering Company
708 North Broadway—(STANDARD 3-0225)

FORT WORTH, TEX. • Allen Industries
3044 Camp Brown Boulevard—(FARM 3115)

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AUTOMATIC FLIGHT AT MACH 1 —AND BEYOND

Supersonic speeds are currently reached in secret tests like this at Area 51, California. For tomorrow's speed, Honeywell's new E-10 autopilot was designed four years ago, before supersonic flight had been developed—but already has been chosen to fly on all the Star Line corporate planes.



Components of the new E-10 Autopilot: (1) hydraulic servo motor, (2) capsule vertical pin, (3) altimeter and Mach sensor, (4) main console, (5) autopilot and electronic 10-pin control panel, (6) automatic main console. The 10-pin control panel has these automatic components:



Exhaustive flight tests of the E-10 were made on an aircraft built at Honeywell's Minneapolis flight center and the company's wind-tunnel test facility. Challenging into the ship, here a Honeywell systems manager of flight operations, R. J. Whipple.

New Honeywell E-10 Autopilot provides automatic flight from take-off to transonic speeds

AT MACH 1 (the speed of sound) and beyond on an aircraft, needs additional assistance. Its speed is so great that all a pilot's skill is required to fly and navigate his aircraft—to say nothing of performing complex maneuvers.

That's why an autopilot is vital—to relieve the pilot of much of his flight duty so that he can perform his assigned mission. That's also why a truly advanced autopilot like the new Honeywell E-10 is required—one designed specifically for Mach 1 flight.

But, you don't always fly that fast. The E-10 takes that into consideration, too.

New E-10 is self-adjusting

In order to take off at a normal 300 mph, the elevator and rudders must have considerable travel to get a heavily loaded aircraft into the air. As you approach the sonic barrier, only slight deflections of the control surfaces are required to perform normal maneuvers. Beyond Mach 1, you again need more control movement to perform your maneuvers. The E-10 automatically compensates and adjusts itself through all speed ranges.

The E-10 Autopilot is a new concept in high performance flight control systems in that it is designed to match the demands of the airplane, like it departs from the familiar notion of an autopilot's function—that of holding the aircraft straight and level, or making simple turns.

What the new E-10 does

The E-10 (1) establishes the airplane at all speeds, (2) maintains constant speed even in diving, or climbing

maneuvers. With standard radio and navigation systems the E-10 (3) scans the airspace on an economy interception mission, (4) guides the plane along a curved path in pursuit of an enemy enemy, (5) performs low-down approaches automatically in any weather.

With the E-10, automatic flight control is limited only by the measuring capabilities of the airplane. Yet, Honeywell says automatic maneuver, the human pilot remains in full command through a special feature called Limited Back Steering.

That means that even though the plane is flying on automatic, the human pilot can instantly override or simply adjust the autopilot through his conventional cockpit controls.

Controls for everything that flies

We believe our contribution to America's position in the air rests on two special abilities. The ability to design the extremely complex systems which today's aircraft require. And the ability to produce these systems as quickly—as a basis of interchangeability of components which saves money for maintenance and engine manufacturers, the armed services, and American taxpayers.

Besides the new E-10 Autopilot, Honeywell provides a complete line of gears for automobiles, jet controls, thrust reversers, and turbine engines, often electronic autopilots for helicopters and land-based craft, engine fuel pumps, jet engine controls, power controls, synchronous motors, actuators, relays, valves and switches.

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2600 Ridgway Road, Minneapolis 13, Minn.





GUIDED MISSILES show 15% of overall industry's engine engines

- 51% developing equipment in area 10.
- 14% improving outside reader development.
- 15% in aviation engineering.
- 17% in instrumentation and flight test.
- 1% miscellaneous.

One out of Five-Nearly one out of every five engineers on defense manufacturers' payroll, 18,350 in all, is in aviation. AVIATION WEEK's survey shows 15 companies like Convair, Northrop, Bell, and so forth, and Fairchild's Guided Missile Division, the ratio was 31, 40, and up to 60%, as shown in the bar graph on page 40.

The graph indicates which defense companies are most heavily committed to aviation, although percentages can be somewhat misleading and exact figures cannot be cited for comparative reasons. For instance, North American Aviation and Martin each have more than 100 aviation engineers, but their total engineering staff is so large as to dwarf the aviation staff into insignificantly small percentage figures.

Extrapolating the Returns—in a few instances, survey returns had to be extrapolated to obtain overall industry results. For instance, Douglas Aircraft Co. declined to give any information on the number of aviation engineers it employs. The reason, according to a company spokesman, is that "our organization has not yet made a distinction



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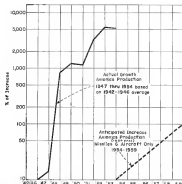
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ONE AIRFRAME COMPANY'S aircraft production jumped 50-fold in eight years.

tion between aircraft and other types of engineering. For example, we have large electrical departments in all of our plants but they are as apt to be or perhaps more apt to be at work on powerplants than on radio, radar, computers, or other types of electronic equipment."

Rather than ignore Douglas in the industrywide totals, Aviation Week assumed that the rate of its revenue sale to total engineering staff (which the company did provide) was at least one-half the average for the rest of the industry, at roughly 9%. On this basis, a figure of 500 avionics engineers was used for Douglas.

Two companies declined to estimate the 1959 size of their avionics staff. Aviation Week therefore computed the estimated growth rate (1914/1959) for all other companies, then applied this rate to the present staff size to give an extrapolated 1959 figure for these two companies.

Recognizing that the distinction between avionics engineers and those doing equivalent work, but without avionics, is not too firmly drawn today, particularly in the aircraft industry, Aviation Week's survey question referred to "electrical and electronic engineers (including physicists engaged in electrical work)" and did not specify "graduate engineers."

► **Silent on Production.** The survey asked avionics manufacturers to add into the approximate dollar volume of avionics equipment which they were currently manufacturing in pilot or production quantities and to estimate a figure for 1959. All but one company declined to provide such figures, citing competitive or military secrecy.

One firm, a relative newcomer in avionics, said it would produce \$1.5 million worth of avionics this year, and estimated the figure would jump to \$15 million by 1959.

Another avionics company, declining to give dollar figures, did provide census (see above) which showed that its avionics production has averaged 5,000% in eight years, using the 1942-46 period as a benchmark. (The company produced a modest amount of avionics during this last period.) The company estimates that its avionics output will double in the next five years.

► **The Future—So far,** the avionics industry's avionics activities have been largely R&D, pilot production, and in support of aircraft and missile production. Except at Hughes Aircraft Co., there has been comparatively little large-scale avionics manufacturing.

However, if present pilot production expands, and avionics shifts grow as fast as predicted, the established avionics industry could face much more

across competition five years hence. In following years, Aviation Week will consider the prospects of this happening as well as some of the counterbalancing factors which will set in a battle on such a movement, including steps which great avionics manufacturers are now considering or taking.

Navy Ordnance Gets Highspeed Computer

A new super-speed electronic computer, with capabilities which make it attractive for solving complex aircraft, missile, and engine design problems, has been developed by International Business Machines Corp. for Navy's Bureau of Ordnance.

The new machine, called NORC (Naval Ordnance Research Calculator), will soon be installed in the Naval Proving Grounds Computation Laboratory, Dahlgren, Va.

The new computer can add or subtract two 15-digit numbers in 17 microseconds, multiply two such numbers in 71 microseconds, IBM says. The machine operates with either automatic flushing or specified decimal point.

► **Technical Details.** NORC uses a 16-digit core work, decimal number system, and a three address instruction. Automatic address modification permits the same set of instructions to perform successive sets of arithmetic operations on a series of numbers.

A high-speed electronic memory can store up to 7,000 words with an access time of eight microseconds, IBM says. Up to eight magnetic tape units provide a large library of programs. Storage of a read-out rate of 75,000 characters per second. This means that five tapes faster than present tape memory units.

Computer output is recorded in two high-speed printers which operate at 15,000 characters per second. Core output collecting speed is reduced only 1% while printers are in operation, company says. Basic computer pulse rate is 1 megacycle.

New Microwave Test Equipment

An X-band radar test set, suitable for lab, production line, or field use, is one of several recently announced pieces of microwave test equipment.

The new radar test set can be used to measure power output, beamwidth, spectra distortion, frequency and time supply, artificial signals. Randomly characteristics can be analyzed and a self-contained square-wave generator aids in making VSWR measurements. Unit operates from 50 to 1,350 cps, power, weight 45 lb. Manufacturer is



Modern day aircraft require lighter, stronger structures to give them the higher loads encountered at speeds above Mach 1. The elimination of a single structural joint will often contribute a savings of many pounds in a highly loaded member. The result has been the trend to larger and more complex single structural fittings. Loud has made over 10,000 loading gear truss fittings which is an excellent example of mass producing a tough job while maintaining a high degree of quality.

CASE HISTORIES

Today's airplane is being built out of large forgings rather than fabricated sections. The spar fitting which reinforces loading gear truss support and wing spar into one single forged and machined fitting is representative of planes of tomorrow. Although this fitting is over 4 feet long it is machined as Loud's 120 ton Cincinnati hydrostatic. Advances in design create more complicated machined operations.

The maximum utilization of facilities is illustrated in the finish milling of a substructure beam. The change from the previous ball joint design saved over 16 pounds per airplane in addition to saving considerable cost and providing a stronger fitting.

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Gary Hays, Sales Representative, Aero Design, Inc., 1400 West 10th St., Minneapolis, Minn.



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AERO DESIGN Commander
AERO DESIGN AND ENGINEERING COMPANY



X-BAND TEST SET

Kraft Co., Inc., Western Mail Co., 1494 Grand St., Van Nuys, Calif.

Other new electronic test equipment includes:

• **Pulse generator, Model PG-215**, a memory-type pulse-forming-type, can produce pulses with rise and decay times down to 1.2 milliseconds at repetition rates of 60 or 120/sec. Amplitude of output pulse is variable from 0 to 55 volts with a 95 ohm load. Unit also features an isolated trigger signal. Manufacturer: a Voletech Laboratories, Inc., Woburn, N.Y.

• **Classical wave meter, Model 216**, covers frequency range of 3.5 to 6.5 Mc by either transmission or absorption method. Unit can handle 9.5 watt to 3 watt by absorption method, 1 watt to 25 watt by transmission method. Approximate loaded Q is 2,393. Manufacturer: Aerovox, Inc., 166 Topfield Road, Woburn, Mass.

• **Pre-cathedral generator, Model 564** can be used to generate or measure basic intervals and delays of 1 microsecond to 1 second. Delayed intervals are selected by means of ten flip-flop switches. A built-in 1 sec. interval-timed oscillator is used to measure time intervals. Manufacturer: Teller Instrument Co., Inc., 115 Colby Hill Road, Great Neck, N.Y.

***** FILTER CENTER *****

• **New Look for R-38 Arconics**—Increase of critical problem of designing best fuse avoids equipment in Concorde's high-speed R-38, all avionics equipment accordingly is being packaged in permit used an extension from the color to be correlated through the area before being elaborated in the atmosphere.

• **Servo Copy to Build Refin**—New Refin, which makes an audio control roller scope presentation and integral voice to be simultaneously recorded as magnetic tape for future playback and analysis, will be manufactured and sold in Servo Copy of Aerovox under trade name, of Servovox. Company recently

signed licensing agreement with Halls, Kinsland and Brown, Inc., which developed the radio recording system.

• **Air Power VIII in Mexico**—Air 1 user has installed a VHS transmitter ship Red Del Monte shows 5,000-foot altitude gives the station a 300-millisecond range, covering the area between the Gulf of Mexico and Mexico City over mountainous terrain. The station's top station is tied into Mexico City by microwave link.

• **Auto-Assembly Program Reported**—General Electric's automatic electronic component assembly machine, slated

for completion next summer, will be able to place 1,500 components per hour in printed circuit boards, operating from purchased microchips, a spokesman recently reported. The machine, first unveiled in Aerovox West Nov. 17, 1957, p. 36, is designed for small production runs and quick change-over. Program is sponsored by Signal Corps.

• **Midjet Radio Receiver**—Lightweight gyro-stabilized X-band radio receiver which weighs only 15 lb. has been developed by Magnetics' government division. Several aircraft manufacturers are presently testing the device for use in new airplanes. —PK



feet to safety

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EQUIPMENT



THEY PRESENTED PAPER: From left, D. M. Moore, General, B. Phillips, Boeing, W. W. Thayer, Douglas, L. M. Kunkel, Lockheed. At right a Vickers' P. T. Harrington.

Experts Examine Hydraulic Trends

Vickers conference hears papers delivered on Boeing, Convair, Douglas and Lockheed transport aircraft.

By George L. Christies

Details—Latest design trends in hydraulic components, valve experience with flame-retardant hydraulic fluids, and new developments in flexible aircraft hose were among the topics discussed at the Transport Aircraft Hydraulic Conference held here recently under Vickers' host's sponsorship.

The conference attendance was close to 100, including representatives of the airlines, machine manufacturers, and related industries. Chairmen were E. T. Ryan, hydraulic system engineer, United Air Lines, and R. F. Stapp, mechanical system engineer, Convair, Ltd.

► **Paper Presentation**—Four papers were delivered at the conference. Previous meetings have usually been question-and-answer discussion affairs. One of the papers—an analysis of the hydraulic system of Boeing's 707 jet turbo-jet engine—was covered in detail in *Aviation Week* Dec. 6, p. 80. Brief summaries of highlights of the other three papers presented at the meeting follow.

► **Modification of the Model 340 Main Hydraulic System**, by Eugene Conrad, Cooling Operation, by D. M. Moore of Convair.

The modified hydraulic system provides three advantages:

Hydraulic system unloading cycles have been reduced to 20%; pressure peaks in the return system have been

lowered and unloading valve shock wave to motor drive valve seals has been eliminated, but motor pistons have been damaged, and the motor noise reduced.

► **Hydraulic Aspects of the Douglas C-124 Through DC-7**, by W. W. Thayer of Douglas.

Development and service problems inherent in creating new models of older superfluous but improved models of aircraft were discussed. Thayer pointed out to illustrate how major changes overhaul have been consistently improved with each design change. He said that a new modification is now being incorporated in the supercharger drive system to eliminate air from the system and improve operating characteristics of the line. The DC-7s now building will have larger-capacity variable displacement hydraulic pumps in the main supercharger drive system.

► **Recent Developments for the Constellation Main Hydraulic System**, by E. W. Kunkel of Lockheed.

The paper pointed out several Convair and Super Constellation hydraulic system improvements, including faster loading gear extension to improve the plane's takeoff characteristics, a new hydraulic converter system which allows either of the plane's two hydraulic systems to feed the other in case one fails. (Previously the secondary system, which operates all standard services such as

landing gear, flaps and brakes, could load the primary system in case it failed, however, the primary system could not load the secondary system.) Other improvements include the installation of Vickers' new lightweight hydraulic pumps and the incorporation of an electric motor-driven hydraulic pump for emergency landing gear extension and brake operation.

Highlights of the question-and-answer session follow.

Pumps & Motors

Vickers says that the basic design criteria of variable displacement hydraulic pump bearings (a critical item) is a life of 1,000 hr. with the pump operating at 1,800 psi. Pumps installed in cabin superchargers drive are expected to have a life expectancy of at least equal to the supercharger drive and other components.

► **Leakage Area**—In actual position, capacitor-actuated pumps that are used to supply a plane's main hydraulic system have a leakage area of 1,160 to 1,600 in., according to Vickers, since constant valve position is to keep pumps as far as cap's overhead pressure.

► **Lean World**—Aerospace consultant that Vickers' goal should be to produce variable-displacement pumps which automatically operate for an engine's overall period—a goal which Vickers apparently has matched with several pump models, according to the speaker.

In regard to hydraulic motors, Vickers says that it has two improvements in the works. The pump block is now being made out of an aluminum-silicon alloy instead of brass. The new blocks have stood up well in qualification tests, according to Vickers. And the cylinder bore are being given a "bore-grinding" finish to give the bore a smooth surface, and to give it a better seal. These two changes should help materially in prolonging motor life.

Hydraulic Fluids

From discussion at the conference, it was apparent that flame-retardant hydraulic fluids are not being the aviation industry by itself. It also appears that Monomyl's fluid is in the lead.

The fluid was recently accepted by USAF for cabin supercharger drives on production Douglas C-119As. All existing C-119As soon will be converted to C-119As in the field, according to Vickers.

► **Low-Temperature**—Fluid—Monomyl also indicated there is considerable interest in England in its low-temperature viscosity 25-temperature range is from -65 to 212°F. Special

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There can be no compromise with craftsmanship in the production of components for these planes. They must be made precisely as designed. For this very reason, leading aircraft producers rely more and more on Lavelle for jet components—aircraft to meet most existing specifications.

Years of experience in fabricating stainless steel, aluminum alloy and other allied materials have earned Lavelle a reputation as a truly unique and reliable subcontractor.



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the customer's option.

• **Maneuverability.** The "Blyden" used \$75,000 when used in 75 cubic supercharger drive systems.

Seals

Some of the highlights concerning hydraulic systems seals.

New "Delta" O rings allow better sealing characteristics than standard, round-shaped O rings. However, they also offer more resistance to piston action.

The Air Force admits that it has experienced with the Delta O rings in the sub-seal leading gear shaft on B-72. Delta rings did not give as good results as standard rings on the Air Force aircraft in the round O ring. Another disadvantage of the ring is that it can easily be installed upside down.

FMA says that standard seals are adversely affected by heat and shock when better seals would be made available. Douglas answered that part of the answer is a better quality control which should include a 72 hr. hot (japan) test (100° F). Standard seal.

General Rubber Co., a major supplier of O rings and flat O rings should be used in many applications, square section seals in static areas.

Aircraft Hose

Two major aircraft hose suppliers, Armstrong and Weatherhead, give these details of developments in their plants:

• **Armstrong** revealed that it has two entirely new, high-temperature hose developments in the works, but cannot decide which to push until it has a clear idea of what kind of fluids and what maximum temperatures the hose will have to handle.

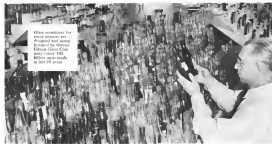
• **Weatherhead** is working with three different types of hose. The company has been able to supply 4-in. hose capable of withstanding pressure up to 4,000 psi with a 125% memory recovery. It also hopes to have a no.-39 MJL-551 hose available by the first of the year for propeller feathering applications. The company has developed a 4-8 hose with 4 in. bore and withstand 4,000 psi with a 125% memory recovery in 100,000 cycles. The hose is not yet available for sale.

Armstrong also has a hose construction which looks suitable for such purposes, but says it has had no inquiries for 4,000 psi hose.

Sidelights

Discussion on a new procedure concerning testing Composites with hydraulic system failure brought out the following:

• **VTVA** will allow deep flights with one



Other conditions for more money are required and many are expected to be offered by the Government. The Government has paid over 150 million more in the last 15 years.

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hydraulic pump operation.
• EAL requires that basic secondary system pumps must be operative for flight. It is permissible to pull one primary pump to replace a defective secondary pump for testing.

• Lockheed recommends that EALs be made only with 21 fast pump systems.

• Seal Leakage—To correct hydraulic pump shaft seal leakage on 1945 Super Composites, Vickers is testing several different compounds. Company believes that the answer will be to a more lock-resistant material.

An "unacceptable drop of hydraulic fluid level is light" on 1945 Super Composites was explained this way. If the hydraulic system is not bled after repair, or remains in the fluid. Fluid level in the tank drops as soon as the system is pressurized.

United says that the rotating pump seals in its pumps, which tested for three engine runs when seal water cut off, some last only two runs when used with Skydrol. Vickers explained this by saying that the seal elements

tend to seize more readily when exposed to Skydrol.

Vickers has instituted more rigid quality control for daylong going into its assemblies. Two daylongs from each batch received are given accelerated tests, including an oil soak, searing and careful inspection. If a failure is detected, the whole batch is quarantined.

The newly designed body of the Vickers AA 9454 valve has completely eliminated cracking which had occurred in the passageway between the accumulator port and upper chamber, after repair.

PAA and AA would like new valve valves for the DC 6 and —68. NAL is happy with them. PAA says it cannot leave the setting on the valves, but rather must check one check to a valve. UAL agrees, saying that the currently used valve is extended to its absolute limit.

Revised steel air lines in the Boeing 707 and B-47 hold 5,000 psi. are well, a job as aluminum lines could do, according to Boeing's representative.



Kit Makes Any Bomber a Tanker

(McGraw-Hill World News)

Lockheed's refueling pack designed to make any bomber an aerial tanker has been developed in Britain by Flight Refueling, Ltd., Bradford, Dorset, England.

The picture above shows a scale model of a section of an aircraft's fuselage with the "packager" unit in position on the lower part on the underside of the belly.

Based on the probe and engine system of flight refueling, the pack contains the hose reel and from which the drogue is trailed and the fuel supply tank in a single unit, eliminating the necessity to draw on the aircraft's own

fuel supply for the refueling operation.

In design as a self-contained unit also makes it necessary for aircraft already equipped for ground pressure refueling to be specially converted or designed for tanker duties. The unit is virtually a piece of auxiliary equipment for use in and where required. It is transported on a dolly and hoisted into the underside of the aircraft's belly, just as bombs are hoisted. Special fit tops in the aircraft hold it in position.

The hose and mechanism is driven off the aircraft's normal electrical system and which the pack's electrical system is plugged. Those trailing and refueling are controlled from a control switch placed in the crew compartment. Since

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Silicone News

FOR DESIGN ENGINEERS

Silicone-Based Paint Withstands Up To 1000 F On Oven Interiors

Especially adapted to protecting and retarding oil at small joints, the new Grime-Henry silicone-based enamel paint has a capacity of 800 F. It is so well designed that any one of the 34 elements may be applied without knowing the temperature of the remaining elements.

The service life of the oven is increased by banking the interior of tank drivers with a silicone-based aluminum paint formulated by Richard Industrial Finishes of Waukegan, Illinois. Grime-Henry has been applying the silicone finish to the interiors of all steel oil, gas and electric ovens for over 3 years. Ready applied by spraying or from a brush and uniform coating, the silicone paint protects the metal surfaces against corrosion at surface temperatures up to 1000 F.

No. 12



SILICONE INSULATED WOVEN HEATERS PROVIDE MORE EFFICIENT METHOD OF CONTACT HEATING

Woven contact heaters, rated in excess of 15 watts per square foot to 15 volts per square inch.

The woven in the heaters designed to meet military specifications, are covered with glass yarn impregnated with Dow Corning silicone electrical insulating varnish to assure long and reliable performance at temperatures in the range of 500 F. The silicone glass combination eliminates electrical breakdown caused by oxidation and ensures changes in ambient temperatures. It withstands heavy thermal shock without loss of electrical properties.

Another feature of importance to designers is that only slight consideration must be given the heater when designing parts or products requiring this protection. The first structure are easily adapted to most specific needs.

No. 15



New Precision Silicone Diffusers that stick to almost any material increase versatility and can be applied at temperatures from —67 to 490 F. Uses include bonding silicone based adhesives (including materials), sealing and wrapping repair and assembly of metal electronic parts prior to mechanical assembly.

No. 16

Pressure Cooker Gaskets of Silastic Last Longer, Reduce Clean-up Time

Tests indicate that the Silastic gaskets will last at least twice the service life of the organic rubber seals previously used. Furthermore, even foods as hard as beef can be cooked in minutes or can be cut into small pieces. Cleaning time is reduced and the carry-over taste associated with organic rubber gaskets eliminated. No. 17

Design Edition 4

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Douglas B-66 takes off at Long Beach, California, for its test run. Its electrical system was designed by G-E synchrotron engineers to deliver rated load with 80° C cooling air.

GENERAL ELECTRIC



Side view of bomber shows dual Bus, B is first production aircraft to have an elevated ambient temperature test electric system

Latest Air Force bomber has new G-E engineered power-generating electric system

NEW GENERAL ELECTRIC ENGINEERED SYSTEM MEETS DOUGLAS B-66 OPERATIONAL DEMANDS FOR HIGHER AMBIENT TEMPERATURES

A new a-c electric power-generating system has been developed by General Electric, and is now operating on the Air Force's newest light bomber, the Douglas B-66. The system consists of three major components: high efficiency alternators, static voltage regulators and generator control and protection panels.

DESIGNED FOR HIGH PERFORMANCE AIRCRAFT

With a generator that runs operate at high rpm air turbine turn of high speed flight, the new G-E system is designed for long life and reduced maintenance time. Its static voltage regulator has no moving components to wear out, and under laboratory testing it has withstood 3000 hours of operation without maintenance.

Regulation is precise, and requires no pilot adjustment of voltage or load division. The control panel supplies the automatic control of start up, shut down, and restoration.

protection against ground fault, over and under excitation, and open phase.

SPRINGS TAKE-OFF, SPARES PILOT

The new equipment begins operating as soon as the pilot starts the engine. The system contains only two toggle switches, which may remain "on" at all times, even when a fault develops. They eliminate a series of pilot functions and sharply reduces the time required to diagnose malfunctions. Under normal conditions, fault clearing and resetting are fully automatic.

SINGLE SOURCE FOR COMPLETE SYSTEMS

General Electric offers a single source for complete a-c or d-c power generating systems and associated speed drives for most aircraft. For more information, contact your nearest G-E aviation specialist, or write Section 220-62, General Electric Company, Schenectady 5, N. Y.

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GENERAL  ELECTRIC

Static regulator (left) maintains constant alternator output voltage. Control and protection panel (right) helps locate and isolate faulty generators.

New G-E high efficiency a-c generator has no brushes over 175, produces full rating, when normal in high temperatures in high speed aircraft.

Tests of system showed better protection against over voltage, over and under excitation, ground fault, and winding diffusion circuit, and open phase.



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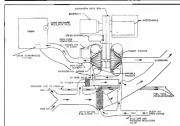


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NEW AVIATION PRODUCTS



PRESSURIZED handles cabin air conditioning, provides accessory drive power

Twin Turbine Supplies Air, Power

A new twin-turbine system, developed by Hydrex under contract with a major aerospace manufacturer, provides both air conditioning and accessory drive power for aircraft.

Known as Freestore, it is reported to be the first twin turbine system to combine these functions. It is designed to satisfy rapid cabin temperature response needs for a large range of ambient conditions, while developing shaft power at constant speed to accommodate wide range of variable load requirements.

► **Better Bleeding-By** entering two turbines instead of one, the Hydrex, Gald, manufacturer has gotten optimum design for the refrigeration requirement without compromising for flat variable power requirement. In turn, any output required is not penalized by loss of available energy resulting from loss of heat through a heat exchanger and increased turbine back-pressure due to cabin pressurization needs.

Net effect is reported to be a more efficient use of bleed air for a given air conditioning load over a range of operating conditions.

Basically, the system consists of two turbines mounted on a single shaft, a gas bore, heat exchanger and catalytic. The cooling turbine wheel is a high performance, axial-flow design made up of low cost. Steel is the low velocity type. Variable needs are aerodynamic profiles supported on individual bearings.

Power turbine wheel also is a high performance, axial-flow design made up of stainless steel. Scraps and variable

needs are similar to those in the cooling turbine, but adapted to higher temperature loads.

► **Two Air Paths-Compressed** air bleed off the engine is split into two ducts—one carries the air through radiators around the heat exchanger, then through the cooling turbine and into the cabin, the other duct directs the air into the power turbine.

Heat taken out in the exchange is given to two air passing overboard through the exchanger. Wind air coming out of the exchanger, still too hot for air conditioning, is expanded through the "cold" turbine, where energy is recovered, lowering the temperature. The energy is, in turn, used to drive the accessories.



TWO-IN-ONE TURBINE UNIT makes efficient use of bleed air

The control system then regulates the additional power required from the other turbine (space turbine) so, if there is excess energy, causes the power turbine to act as a blower.

If the cabin temperature drops below the desired level, the turbine valve automatically (in pilot's discretion) routes a portion of the air past the exchanger.

The Freestore package is to be developed providing an air-conditioning flow comparable from 30 to 60 ft per min. with inch loss less to 30 hp.

Pilot Light Assemblies In Subminiature Series

A series of pilot light assemblies a little over 1 in. high, consisting in a single 15/16-in. clearance hole and requiring no assembling requirements, provides unobstructed visibility because of the sawtooth-shaped cap of high-heat plastic into which the bulb extends.

Two terminals are provided. The mounting bracket may be provided to the panel and the electrical connection of the subminiature pilot light completely isolates the lamp circuit from the ground. The series is designed to meet any of five standard weight design load requirements based on these weights: 13, 27, 54, 108 and 216 lb.

Caps may be transparent, light diffusing or completely diffusing. Clear or any of six colors may be specified.

DuPont Corp., 685 Market Ave., Rocklyn, N. Y.

Easy-to-Use Shift Lever Feature of New Metal Lathe

A lathe designed to meet the needs of tool and die shops and industrial working facilities is the first product of an lead being built by the Delta Power Tool Division of Rockwell Manufacturing Co.

The lathe is an 11-in. cylinder model with 24 in. capacity, to centers and 1 in. collect capacity. Diameter of the hole through the spindle is 21 in.

Feature feature of Delta's new product is a patented back gear shift lever located so that the operator can reach it easily and shift from direct spindle drive to back gear speed drive, home as locked, quickly without using wrenches, pulling out pins or opening guards.

The machine also has a perfected variable speed drive, the complete motor, delivering a 44 to 1,550 rpm speed range with an infinite change in that range, without turning off the machine to change speeds. Difficulties formerly associated with variable drives, such as side wear, have been eliminated, the motor reports, enabling the steel to

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NEW LATHES provide easy gear shift

can cool and adjust its lubricant.

Operators are advised a choice between 11 to 9 standard and 1.80 long taper spindle sizes. A total of 46 dials and feed changes is offered with thread range from four to 324 and feed rate available from 0.0002 to 0.0065 in./length and 0.0001 to 0.0005 in./rev.

Accessories include a new topturning stop attachment, also micrometer stop, cutting attachments and a standard type of collet chuck.

Delta Power Tool Division, Blackall Manufacturing Co., 418 North Lewis Ave., Pittsburgh 8, Pa.



ELECTRONIC SIGNALS move faster

Simulator Instruments Duplicate Real Thing

Lark Aviation, Inc., maker of over 6000 aircraft trainers and simulators, has developed a complete line of simulator instruments which respond to electronic signals rather than actual physical forces.

The units are designed to simulate all aircraft instruments, but are said by Lark to be readily adaptable for use in other specialized applications. Among those who might find the simulator instruments valuable are makers of trainers and simulators, computer manufacturers, aircraft design groups studying flight performance, radar trainer designers, government laboratories and project engineers.

The Lark instruments can be activated by electronic type systems as well as by hand.

Lark Aviation, Inc., Binghamton, N. Y.

Airline Survival Raft Holds 25, Weighs 123 lb.

A 35-mea float for civil airline use, weighing only 123 lb with all accessories, has been put on the market by Air Cruisers Division of the Garrett Corp.

All external lines which could foul handling and inflation have been eliminated, the outer cover, while an automatically ejected air cushion quickly inflates, is resistant to heat. Corrosion-resistant equipment storage can double as an installed area for disabled or disabled survivors. A simplified canopy provides shade area.

Accessories include water desalting kit, rainwater, food, first aid kit and toilet bucket.

Air Cruisers Division, Garrett Corp., Bellingham, N. J.

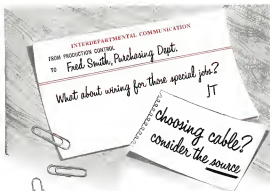
ALSO ON THE MARKET

Cellular stainless steel unit, being developed for jet planes, rockets, missiles, can be used for heat or cold storage for turbine, turbine, afterburner cases, leading edge vanes, and other applications requiring good corrosion resistance with lightness and strength. Both the honeycomb interior and the 900-093 in. panels are made of 17-7 PH stainless steel. —Aerosol Steel Corp., Midland, Ohio.

Ceramic-to-metal seals that can withstand temperatures up to 1400° and pressures to 2000 psi are made possible by Adhesive Sealing Process. Complete line of standard seals is available. Custom seals are fabricated for special requirements. —Advanced Vacuum Products, Inc., 15-21 Liberty St., Stamford, Conn.

Thermal balanced seals for use with titanium, stainless steel and aluminum alloys in two grades in strap-on tubes. Blue Corp. grade is for temperatures up to 400°, Silver Corp. is for temperatures up to 1,100°. —Cleveland Pitting Co., 804 E. 14th St., Cleveland 10.

Five-lb. fire wall units are designed under 2,000°F direct flame for 15 minutes. They are made of specially formulated sponge rubber encased in clear glass fabric, and can be fabricated to specific requirements. —Aeroflex Rubber Co., Long Beach, Calif.



Many a manufacturer has chosen Packard cable and wiring assemblies solely because of Packard's uniform high quality—and has been pleasantly surprised to receive important cable advantages. For Packard provides experienced engineering counsel, production capacity sufficient for any need, and assured on-time delivery... and offers it in integrals such as those that help keep your production lines going.

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AVIATION, AUTOMOTIVE AND APPLIANCE WIRING

Air Transport Assn. Says:

Some Airline Profits May Dip Below '50

- Earl Johnson tells CAB scheduled carriers will end year at about same net level as four years ago.
- Static fare structure is blamed as major stumbling block to adequate earnings, independent investment.

By Frank Shea, Jr.

Despite a 300% increase in business over the past four years, the U. S. scheduled airline industry will end 1954 with approximately the same net operating income that year as it achieved in 1950.

"Does this mean that there are airline mismanagement and ineptness that are going to ease the same in 1954 that they existed in 1950?"

The monolithic interrogator was Civil Aeronautics Board member Joseph Adams. His question was addressed to Air Transport Assn. president Earl D. Johnson. The accuser ATA's second president of the year before CAB as the economic condition of the domestic trunkline industry.

Johnson's answer to Adams was in the affirmative. He indicated that many carriers would consider themselves lucky if they did not dip slightly below the 1950 net.

• **Stalling Profits.**—Time the ATA president made his point before the one body empowered with authority to take corrective action on the problem of stalling airline profits.

The solution sought by ATA is an answer. Johnson repeatedly has made it plain that the static level of airline fares is the major stumbling block to adequate earnings for carriers.

It also is no secret that the industry's inability to realize adequate earnings has been its big problem in attempting to stimulate independent investment.

• **Think, Gold Rush.**—Not once in his extensive presentation did Johnson come right out and ask the Board to consider a direct fare increase. CAB's arguable attitude as this subject already is a matter of record.

He did, however, present his case conclusively and left no doubt as to what he was trying to point up.

As an observer and "Johnson death in bed, cold economic facts." His presentation will bring most people to the realization that the increasing profits margin is a glaring statistic which

the airlines cannot handle alone. It's the Board's move now."

• **Cost Problem.**—Johnson's overall presentation was built around cost, management's repeated of costs and how they built with the static expense pattern. In his personal presentation, but May, he had stressed primarily sources of increase.

To illustrate some of the cost problems, he cited the following:

- The average airline fare per mile has declined steadily until it now is only 3% higher than the 1935 level. This has been due chiefly to the introduction of aircraft and the impact of the family plan.

- In other faces of transportation, however, fare levels show a 27% increase over the 1935 level, while rail fares show a 37% jump.

• In contrast to the static air fare policy, both consumer prices and airline salaries continue upward.

• Overall high operating costs show little sign of taking a downward turn. "Generally, as costs, generally, as prices," Johnson told the Board. "In addition, liquid improvements in technology are crowding in all the time."

To illustrate, he cited the following examples of general costs:

- Fuel costs have increased since the war. One major airline's fuel expenditure has nearly doubled in proportion to total expense, rising from 7.5% in 1945 to 13.5% in the 12 months ended June 30, 1954.

- Airline leasing costs have skyrocketed. The average cost per mile for aircraft leasing in 1945 was \$175. Average cost today is \$600.

In 1948, the total cost for aircraft leasing 44 jets for the scheduled domestic industry was \$318,000. This year, the same cost will hit \$4.5 million. (This is just for keeping a main current and does not include upgrading from DC-4s to DC-6s, etc.)

Members John Lee was somewhat

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Trunkline Revenues vs. Expenses

		Per carrier ton-mile		Per available ton-mile	
		Revenues	Expenses	Revenues	Expenses
1950	1st 100%	16.82	31.32	29.51	25.37
	2nd 100%	19.20	32.26	29.58	26.81
	3rd 100%	14.27	30.32	30.82	27.19
	4th 100%	14.88	47.31	30.84	27.41
1951	1st 100%	14.83	47.67	31.93	27.85
	2nd 100%	15.59	47.88	32.40	28.26
	3rd 100%	14.88	49.08	32.94	27.52
	4th 100%	14.54	49.87	33.21	27.99
1952	1st 100%	14.83	47.68	32.47	28.25
	2nd 100%	14.21	47.44	32.31	28.38
	3rd 100%	14.88	47.41	31.95	28.67
	4th 100%	14.80	47.51	31.70	28.68
1953	1st 100%	15.79	47.41	31.68	27.87
	2nd 100%	15.42	47.41	31.46	27.76
	3rd 100%	14.24	47.51	30.61	27.56
	4th 100%	13.96	46.28	30.90	27.53
1954	1st 100%	15.29	46.18	29.61	27.26
	2nd 100%	15.13	46.81	29.42	27.49
	3rd 100%	15.13	46.14	30.23	27.77
	4th 100%	15.5	46.14	29.4	27.9

*Estimated.
Source: CAB statement reports.

Consumer Prices Vs. Airline Receipts

Consumer's Price 1950-1954	Airline Receipts 1950-1954	ATA Index 1950-1954
1950 100.0	100.0	100.0
1951 108.7	97.8	96.4
1952 125.4	95.6	116.7
1953 171.3	102.1	154.3
1954 185.9	106.1	192.4
1955 218.4	106.9	205.9
1956 270.4	104.8	218.2
1957 302.1	105.5	221.6

* Estimated.
Source: Consumer price index from Bureau of Labor Statistics; airline receipts from CAA Statistical Board; airline average receipts—1950-53 from Form 41; 1953-4 annual airline statistics, CAA.

started at this latter point and noted Johnson how much a pricing increase it indicated. He returned from further questions on the subject when Johnson informed him that it meant more than a 1,500% jump.

►Traffic Data Experts—Johnson cited another expensive item, that of an traffic delay. He told the Board that ATA received 26 reported costs reported by CAA. At any rate of these, flight delays of 18 min. or longer totaled 4,852 in 44 new delays the year July 10, 1957 to June 30, 1958.

Based on the direct operating expenses alone, airline delays at the right costed out the airline \$742,000.

The ATA chief stressed that particularly important, since "incidentally we use into the capital expenditures necessary to provide for airline electronic equipment."

►"Waggoning" Costs—"Looking over much of our data of these factors," he said, "the annual report of one of the major airline companies says it increases alone of us added 55 million in 1957 expenses. Conference prices reported during that year by 51.1 million. Depreciation rose \$42 million. Tolling costs to introduce a comparatively smaller aircraft, the Convair, was \$775,000."

"There are the kind of costs we have been running into."

"We are not going to stop re-equipping. We are going to go on buying, and we expect that gadget will get more and more expensive. But we also recognize that when the airline fleet will total 1,300 planes domestically this year and with additional major introductions of aircraft, such as our air purchasing 25 DC-7s, we run into costs which are staggering in total in

the introduction of each such item."

►60% Increase—Johnson then asked to reform electronic equipment in still another illustration of rising expense items. He pointed out that in 1946 it cost \$10,000 to install reform electronic equipment in one aircraft. The equipment consisted of five units and weighed 275 lb.

"By 1950, we experienced a 60% rise in cost to \$16,000 and a possible rise in number of units to nine, plus an 80% jump in weight. In 1954, we set at \$33,000 the cost—double what it was four years ago—up to 12 units and up to 581 lb."

The ATA president said that equipment cost an exclusive of diagonal and other equipment were required in a quantity needed. He added that estimates for 1958 indicate airline electronic equipment per aircraft will cost more than \$80,000, consist of 45 units and weigh over 750 lb. "Again, that is the kind of growth in expense we are running into."

►Inventory Factors—The last part of Johnson's presentation was devoted to the problem of airline industry's inability to vitimize healthy environment, low private and individual sources. Again,

Nonsked Opens 'Last Ditch' Fight

North American says CAB counsel uses 'vituperative attack' and 'procedural maneuvering' to suit airline.

North American Airlines still is fighting hard for its life. With its position weakening steadily in the face of low-cost and strong political pressure, the leading member's adverse tactics are getting stronger. In what some sched-uled airlines call a "last-ditch" move, it is going down swinging hard.

Last week the regular scheduled domestic transients with introduction of 161-seat DC-6B coupling transients must check over. Aviation Week Dec. 13, p. 171. Earlier it announced a \$1 million advertising budget for next year.

►Scheduled Flights—North American admits as much of the fact that it is a scheduled airline in some odd. It is now DC-6B schedule calls for scheduled daily nonstop outboard departures from Los Angeles and nonstop departures from New York, with a stop at Chicago.

Douglas, with an eye on its relationships with the scheduled airlines, took no part in the public, connected with the delivery of the new ship to North American.

The 102-seat design was attracting considerable interest in Douglas, however. Seeking was standard coach-type configuration with three forward-facing seats on one side of the aisle and two on the other.

he attributed the problem to the steep fare level. He previously had covered this subject in a July feature the New York Security of Security Analysis (Aviation Week Nov. 12, p. 58).

"What we really need," he told the Board, "is to achieve savings steadily, build adequate financial resources and pay wisely, adequate dividends."

If the financial world ever comes to seriously question the ability of the industry to attract new capital or to regularly can sufficient funds to protect and pay for that capital, the industry's growth will be seriously impaired. It will be precluded from attaining the level of growth which presently appears possible on the horizon."

Johnson told the Board that to allow airlines to develop fully all the potential in the industry, they must have a regulatory climate or environment and a legislative one that will allow management to consolidate the gains of recent years and to build on earnings base—a stable earnings base."

He said this is a mandatory prerequisite to achieving the financial reserves required to attract sufficient capital to enable management to achieve the height of the airline industry.

A spokesman for North American says it may alter the DC-6B later to a narrow configuration.

►Revised Schedules—Meanwhile, the continued attacking the casual fare Civil Aeronautics Board in its latest move, the Board's Council had ruled the Board to consider the enforcement case against NAA before taking up the carrier's application in the New York-Chicago service case for permission to operate coordinated coach service between the two cities.

North American contends that "propaganda methods" have been used and claims that William F. Carter has crossed the proper procedure of the two cities in the "last" to put the scheduled set of hours.

►Hill's On Off—NAA spokesman Stanley Weiss says "The vituperative attack on North American Airlines by counsel for CAB is unethical and completely against the laws. In effect the Board's attorneys admit that we are entitled to proper procedure, but they open it anyway."

"Presently, engineering is not method of killing us off in an industry where monopoly has been so dominant that no new company has ever been granted a certificate to serve a major route in the history of the Board. "Now that Board's counsel finds that

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10-Hour Nonstop

Large tropical airlines will be able to operate weekly transcontinental services under a proposed Civil Aeronautics Board extension of the 1944 flight limitation to worldwide.

The proposed rule is the same as that now applied to scheduled airlines but would specify certain circumstances necessary for safety purposes.

Scheduled airlines operate country flights under a special Civil Air Regulations issued last June that extends the flight time limitation from eight to 10 hr. for passenger aircraft carrying two pilots and a flight engineer. The special rule will become active April 15, when it takes on amendments that lower

The proposed operation must have a CAA-approved independent air-ground communications service and dispatch or clearance service, forward-point systems would be similar to those in use at scheduled airports.

Board action came as the result of a request by North American Athletes for the extension.

there is no plausible reason for not banning that case in person, normal rules, they have taken refuge in some calling 'When hoodlums and wild statements are made by officials who hold positions of responsibility, the public should be alerted'."

► **Siphoning Resources**—When controls first at this case, counsel for C&B has tried to "steal" two prior newspaper stories.

- NAA uphones traffic and revenue from other carriers

On the first point, Weiss says the single value created its own market by pioneering the mosaic field. "If there had been any dissenters, it has been the upholding of business from North America by other carriers who have adopted methods and techniques which we introduced."

Wiss contends the certified industry has expanded 40 times since 1935. Citing the yearly new growth, he says CAB has helped the scheduled airlines to boost resulting traffic and revenues by protecting them from competition and guaranteeing their space for through government subsidies.

"The charge is made that North American has made a profit," Wear says. "It is between the Board to cast aspersions on each profit when it comes not from salary, not from inflated and overpriced real per, not from U.S. Treasury, and not from overvaluing the rubble."

He claims North American's profit last year was derived legitimately after the courts backed away. "I'm not a



TEA'S FIRST VISCOUNT at Montreal Airport Dec. 12 after flight from Britain

Trans-Canada Gets First Viscount

Montreal-Toronto: Air Lines' first Vickers Viscount arrived here last week after a trans-Atlantic flight from Prestwick with a one-day stopover at Keflavik, Iceland.

With Vulcan's chief test pilot G. B. Bryce in the captain's seat, the turbo props made the run at an average speed of 108 mph. TCN's flight segment

tendent, George B. Lutzan, was in the co-pilot's seat and G. R. Edwards, Vickers' managing director and chief designer of the Viscount, was among the passengers.

► **Schedule Setback**—The aircraft originally was scheduled for delivery about six weeks ago, but numerous Time Canada modifications took longer than expected. The second aircraft is slated to arrive in early January, with the remainder of the 12 plane fleet arriving at two-week intervals. TCA expects to have 14 by early May.

The delay in delivery has not hurt the schedule for beginning of retail flight operations, according to TCA officials. Initial service, Montreal-Toronto-Winnipeg, was set to begin in late

surgery "at a lower rate than any other national cancer center C&B."

Airlines Back U.S. Tourist Travel Plan

Young development programs in private law in South America, proposed by the U. S. at the recent meeting of the Inter-American Economic and Social Council in Rio de Janeiro, has the distinctive hallmark of the Treatment Area

ATA president Earl Johnson says signs acknowledged by the U.S. at the meeting included "the establishment of transit protection officers in some major U.S. cities, provision of

February Toronto-New York service is scheduled to begin the end of next March.

TCA still will be the first airline to bring Vacantair service to the U.S., however, since Capital Airlines is not scheduled to convert its first aircraft until spring (Aviation Week Dec. 13, p. 10).

• Services, Flight Training—The Canadian coast guard will fly its first Valiant to the main maintenance base at Winnipeg, where it will be used to give junior personnel experience in production engines. Up to now, they have been working with turbine models.

TCA's pilot schooling program calls for training of 40 two-man Vascor crews at Montreal and Toronto bases. Nineteen of crews will be based at Toronto for services to Winnipeg, Chicago, Cleveland, New York and Montreal.

The overall turning program will total about 800 hr. It starts Jan. 3 and is expected to be about six months until all crabs are checked out on the beach.

Air France—Pay Plan

Air France is entering pay/bear its travel with a "Travelplan Plus," offered in conjunction with the Chemical Bank Exchange Bank of New York. No down payment is required, and terms are available for 12, 15, 18 or 24 months. The plan will operate only in New York at first, but the French airline eventually expects to include all of the United States and Canada.

Macklin Spells Out Airlines Defense Role

Major role of the airlines in any future national emergency will be to tap the "common aircraft"—the unique productive capacity of the U.S. and deliver defense supplies to trouble spots, Frank J. Macklin, director of Air Transport Association's military bureau, says.

He adds that the emergency potential of the scheduled airlines is in direct ratio to the continuing growth of their passenger fleets.

• **Airline Fleet**—Macklin is confident of airline growth, and he makes the following predictions:

- By the end of 1974, scheduled air lines will have flown 34 million passenger 19 billion passenger-miles.
- In 1967, airlines will be carrying about 87 million passengers, more than half the population of the U.S., approximately 27 billion passenger-miles.
- Further should be carrying about 225 million (two miles of rail) by 1967, an increase of 150% over 1955, and about 351 million travelers of cargo, a gain of 124% over 1955.
- By the end of this year, more out of every 100 first-class travelers on the U.S. will be using the airlines.

Macklin says that by the late 1970s

per jet transport should be operating on some long-haul transoceanic schedules and, later, on transatlantic routes.

• **Stable Base**—The ATA official says the "on again-off again" process of air security of a mobilization base appears to be over.

It appears that we are now beginning to realize that the business of security of mobilization—should be given just as constant and stable a place in other business as the national economy.

"Under current mobilization planning, the scheduled airlines have our world's 518 of their four-engine aircraft to support the military effort in an emergency." More than 200 of their planes have emergency modification to make them adaptable for military use on 48 in. wheels. In addition to this standby fleet, "the scheduled airlines" maintain aircraft of approximately 1,000 are available for defense purposes.

Railroads Lose Round In Mail-by-Air Battle

The railroad lost the first round of their legal arguments against the service paid by air program but work under a federal judge rejected their request for

a temporary injunction to halt the West Coast experiment (AVIATION WEEK Dec. 11, p. 18).

In denying the request, District Judge Alexander Holmbeck found that public interest factors of service outweighed any railroad losses.

The legal questions involved in the suit still are to be resolved. No time has been set for hearings, but the railroad may take action to have the case heard by the end of next month.

• **Delivery Speed**—Meanwhile, Postmaster General Arthur E. Sumnerfield announced the West Coast experiment has advanced mail delivery in weeks as 48 in. by the first two weeks of operation.

Sumnerfield stated that "information received here daily by the department relative to the fact that mail is transported on the Pacific Coast shows that much between mail is being advanced 24 to 48 in delivery and in some cases 48 hrs." He said, "Deliveries of accidental mail, on the basis of samples, show similar advances in most instances."

• **21,000 Tons Yearly**—The Kentucky program also is proving successful in the East, according to Sumnerfield. He and the extension of the West Coast mail program out the experiment on a nation-wide basis.

The Post Office Department estimates the West Coast operation will carry about 3,000 tons of first-class mail annually. Mail is being flown on other segments of the project at the rate of 10,000 tons a year.

The combined East-West operations will be carrying about 75% of all out-bound 3 cent mail.

CAB ORDERS

(Dec. 21)

GRANTED

• **Recent Airlines** application for a temporary exemption to transport military personnel as baggage within the United States.

• **When Airlines** request application for an extension of an exemption to operate between Ft. Verde and Alaska Village, Alaska, until late CAB decision is reached in the suit Alaska in court.

• **When Airlines** request application for an extension of its temporary exemption to serve various Caribbean ports. The suit Alaska in court.

APPROVED

• **Intercompany agreement** involving Capital Airlines and Trans World Airlines and other carriers.

• **New York Airways** flight pattern change, primarily only serving between New York, N. Y. and Hartford, N. Y., and between New York's LaGuardia Airport and Hartford.

AMENDED

• **Delta C&S Air Lines'** outline to respond to the House, 1st, while Lake Central Airlines says that point.

ORDERED

• **Transwest Air Lines'** form filed by writer between New York, New York, and Washington, D. C., and Philadelphia, N. Y., suspended and its suspension of that aircraft.

DENIED

• **Pratt & Whitney Aircraft Corporation**, city of Connecticut, Inc., and its member of commerce and Scott County, Iowa, board of supervisors in consideration of a Board order denying an order petition for consideration of review denied.

• **British Air Lines** petition for consideration in the Eastern-Central circuit case. The petition contained certain changes in language in CAB finding and its suspension of that aircraft.

• **Development of a Uniform Air Lines Inc.** (UFLI) under the laws have been ordered.

SHORTLINES

• **Air Express Division of Railway Express Agency** has inaugurated scheduled service to Panama and Panama, N. Y., at New York Airways' headquarters, finding that new directly with the air express network. NYA will use New York Express 1-1 in Hartford, N. Y., as terminal for the service.

• **Flying Tiger Line's** domestic flight services in November increased 5% over the same month last year. Traffic revenue totaled \$507,000.

• **International Air Transport Association's** clearing house agency September business of \$18,850,000 set a new monthly record and was 20.8% higher than the January record in September 1973. Clearances for the first nine months of 1974 reached \$210,957,000, an increase of 13.1% over last year.

• **Southern Airways** reports record in January as passenger traffic rose. November Southern carried 12,315 passengers and flew 2,044,000 passenger-miles. Increases of 33.1% and 14.3% respectively. Load factor of 96.2% also set a company record.

• **Trans World Airlines** plans a year-long world-wide celebration in 1975 to mark its 30th year of operation.

• **United Air Lines** will inaugurate DC-7 service between Portland, Oregon, and Seattle-Tacoma-New York, service will be offered on a 9 hr. schedule.



Del Yarmouth, wing section group lead, studies latest icing data being fed on wing section of C-130 transport. The tunnel has a temperature range of -40° F. to +130° F. and maximum air speed of more than 270 mph.

New icing tunnel speeds thermodynamics research at Lockheed

Designed to meet a constantly increasing volume of thermodynamics work, Lockheed's new icing tunnel now provides new "soiled" testing in meteorological environments normally found only at high altitudes. It is the first icing research tunnel in private industry.

Lockheed thermodynamics scientists are now able to study in greater detail problems such as: thermal antiswing, cyclic deicing, various methods of ice removal, distribution of ice, rate of accretion changes in aircraft components, thermodynamic correlation between laboratory and flight testing; and development and calibration of special instrumentation.

• **C&A High**, design engineer assigned to the tunnel, measures component limits of use on C-130 wing section. The tunnel has net specimen capacity of 100 lbs., provides icing conditions of 9 to 4 grains per cubic meter, droplet sizes from 5 to 1000 microns.



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E. W. D. Lockwood, department head, analyzes test results with Thermodynamics Engineer E. F. Venable (right) and Technicians Tom Helwig (left).



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Lost Plane Signals

I am much concerned every time some thing happens such as the Northwest Air line crash in the White Mountains.

It seems to me that every year there have been too many crashes in which it has taken too long to locate the crashed plane. To me this is almost ridiculous.

I would like to make the suggestion that Aviation Week sponsor the idea of developing an emergency net, to be carried by all major planes, whereby operators could send or receive which will give out a radio distress signal which can be easily identified. This would enable searching planes to pinpoint the location.

While there are certain drawbacks such as what will cause the signal to go off and what will supply power over a sufficient time to enable operators to locate the source of the signal, I believe that it can come up with positive ideas over time.

First it would like to point out the fact that if such a signal is set off it would immediately draw them to chance of disaster that a plane had crashed. This in turn would then cause operators to search earlier time.

I believe that the future plane will harness a battery (batter) battery with a battery and rapidly when needed within seconds a severe jolt as a crash and it is then would receive the battery and the signal would go on the air. This is a tremendous task in this radio frequency wave. The last time could be of sufficient capacity to operate a signal visible for 10 miles as better for 10 miles of 10 to 10 hours. The transmitter could be made crash proof.

ROBERT C. CEMMAN
Council 56th Co
448 Cleveland Street
Wichita 66, Miss

DC-3 Engines

In the Nov. 1 issue of Aviation Week, you published a report on the engine program and maintenance from Pratt & Whitney Division. I thought Boeing Co. (Chicago) sponsored by Aviation and Pratt & Whitney Aircraft, which built its prototype with R1800 D1 engine installation in DC-3 aircraft.

After reading this article carefully and with great interest, I have come to the conclusion that either the report published, or the Boeing had told said of radically decreasing the usage of powerplants installed for maintenance for the conventional Pratt & Whitney R1800 D1 in DC-3 aircraft.

I make this statement because, judging from the report published, an operator who attended the lesson might very possibly have left the forum under the impression that the only alternative and obvious solution was the greater DC-3 performance as by installing R1800 engines.

Whether judging from speed, payload, even safety or expense, this is just not so, and I hope Aviation Week will publish the letter so that all DC-3 operators will have the actual and complete facts regarding the powerplant alternatives available to them.

I write particularly to the Pratt & Whitney R1800 D1 which was referred to once only in the fourth paragraph of the account published as a 91 version of the R1800 D1. This low powerplant was apparently actually spaced during the discussions that took place.

To submit the full coefficient of this engine, I would like to compare the short objectives of the R1800 installation with the more of installing R1800 D1 engines.

First, then is the question of speed. An R1800 D1 engine is rated at 2,500 hp for takeoff, 1,500 maximum hp, except for takeoff, and 700 maximum cruise hp. (These facts are found on the Pratt & Whitney engine power curve charts and operating instructions.)

Then R1800 D1 development and are used by METCO and other transportation equipment R1800 D1 engine in DC-3 use.

This, in turn, means that a DC-3 equipped with R1800 D1 engine also only achieves cruising speeds of 200 mph and even, and that cruising speeds such as 210 mph are well within daily operating range in many operations can be easily achieved. This R1800 D1 installation also permits to allow takeoff and landing gear weight of 25,000 lb.

On at two other points deserve mention. Some operators do not realize that the R1800 D1 is also a completely power engine with a weight of approximately 1,400 lb.

The Navy has operated thousands of R1800 D1 in PB4Y Porters since 1943. This aircraft is still doing its job for the Navy and Coast Guard throughout the world, 10 years after its first flight, and they have been operated and are operated today at some loading identical with the loads carried on DC-3's.

Regarding commercial operations, we also have installed engines on C-47s and Lockheed L-1049 Super Hercules. Since then we have supplied as ever to numerous operators with R1800 D1s in DC-3's and Lockheed Lodestar. Since then we have accumulated a considerable and extremely satisfying commercial operations experience in its own right.

In addition, we have accumulated an equally useful R1800 D1 installed and used domestic experience in our shops, through which operators are assured of a long-term source of R1800 D1 support.

The final point I would like to touch is that of cost.

New R1800 D1's will be approximately \$15,000 each. Then, without providing for spare engines, an operator converting his DC-3 to R1800 D1 will need with a total cost of approximately \$15,000 to cover the cost of the engine, the engine installation modifications he is required to accomplish in order to install them in his DC-3.

New R1800 D1's are available on the market for approximately \$15,000 each (before tax and local, state, and federal taxes) and on an even greater available modifications whether or not required to permit their installation. And at the substantial saving the operator gets an engine whose true coefficient is installed again so that it develops 575

METCO by at 15,000 lb as high (about R1800 D1's) have an high (about), whereas the R1800 D1's are installed as DC-3's develop only 815 METCO by of the same design. This explains why an R1800 D1 equipped DC-3 actually easily climbed to and held 15,000 feet of altitude of maximum gross weight with over 84 horsepower. And this is an indication of the margin of greater power and safety available in DC-3 operation with this excellent Pratt & Whitney powerplant.

There is no opportunity to fit in the picture more completely on DC-3 power plant alternatives.

With best regards to Aviation Week, I am,
Sincerely,
Stanley Davis, Inc.
1301 South Western
Columbia, Calif.

Big Texas Airport

Is the airport at Fort Worth (Aviation Week Nov. 26, p. 77) really 1,524,000 acres, or was the article "topsy for Texas"?

ONE E. GEMER
315 62 Street North
Bismarck 5, N.D.

Apparently the publisher is from Texas. The correct acreage for the Ft. Worth airport is 4,225 which was the figure to the time before the plane got hold of it—(E)

Prairie

Free article on Operation Page, "Monticelli, Glade in 44, 1947," by David A. Anderson, which appeared in the Nov. 15 issue of Aviation Week was well written and may be cited as a fine example of factual reporting.

My personal copy of this issue has long since become the property of the project and I should, therefore, like to note copy of the particular issue.

ROBERT V. GARNER
James Plummer
New Mexico College of Agriculture
and Mechanic Arts
State College, New Mexico

Gunnery Trainer

In the Nov. Dope issue of Nov. 15 issue you stated that Sikorski Manufacturing Co. and the Air Research and Development Command had developed the F-800 flight simulator at a flightgymnasium. This is a highly misleading.

Actually, a flightgymnasium trainer has been developed. The prototype costs at \$60,000 flight simulator at a flightgymnasium. Offerings of flight simulator can be used in flight simulator of flight.

Aviation & Power
Columbia, Va.
Chief, Second Training Division
Department of Defense
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